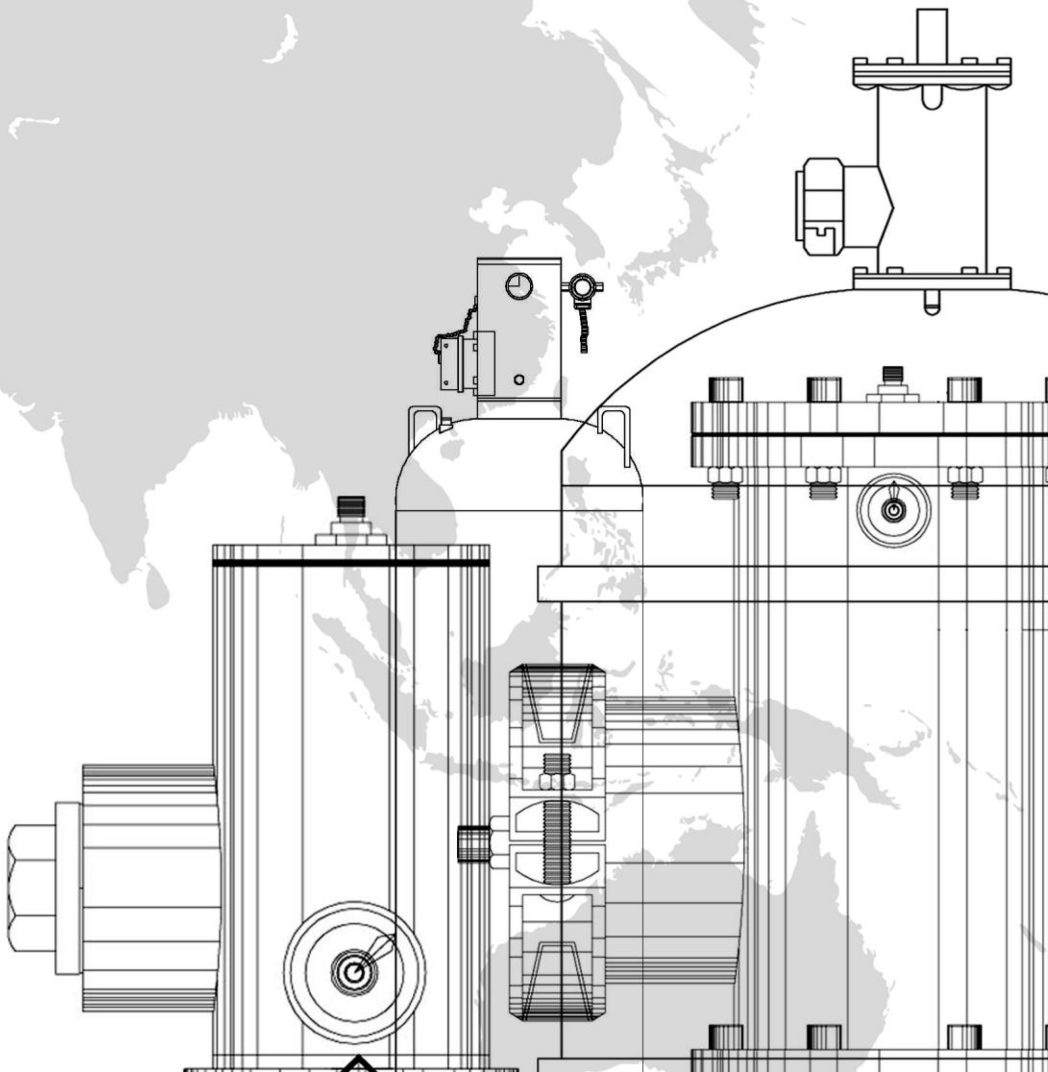
Context Plus

ENGINEERED HFC-227ea Clean Agent Fire Protection System

Installation, Maintenance, and Service Technical Manual



UL LISTED

UL EX16138
CP-90225-D-4
SEPTEMBER 13, 2010

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Preface

The Engineered concept of automatic systems allows a range of flexibility in design parameters. The information contained in this manual will allow a system designer to properly design the Context Plus Engineered HFC-227ea System. It also permits an "authority having jurisdiction" to determine that all required design and engineering parameters have been satisfied.

1 Context Plus 227 Fire Protection Fluid

1.1 Introduction

Context Plus 227 is the brand name for Heptafluoropropane (HFC-227ea) manufactured by Context Plus Limited. Context Plus provides the highest quality assurance of its HFC-227ea and is supported by a team of highly trained and qualified Chemical Engineers and Scientists.

The HFC-227ea is the leading Clean Agent replacement for Halon 1301 in the special hazards suppression industries worldwide. It is traded under various brands including Context Plus 227 (Context Plus Limited), FE-227/FM-200 (Dupont), and Chemori 227™ (Chemori Americas). However, the National Fire Protection Association (NFPA) 2001 Clean Agent makes reference only to the generic name of chemical, i.e. HFC-227ea.

Context Plus 227 received its component recognition from Underwriters Laboratories (UL) and its component approval from Factory Mutual (FM). Both UL and FM are independent third-party organizations that certify the purity specifications as required by the NFPA2001 in order to be an effective fire extinguishing agent. FM Approvals conducts a fire test on Context Plus 227 based on the standards and requirements under FM5600 with the approval identification of 3041301. The UL Listings is based on UL2166 Standard for Halocarbon Clean Agent Extinguishing System Units, edition revision date 03/22/2001. Context Plus 227 is listed under UL File EX16138. All testing were performed in accordance to NFPA2001 (2008 Edition).

Context Plus 227 is an effective fire extinguishing agent that can be used for the fire protection of Class A (solid), Class B (liquid and gas), and Class C (electrically energized) hazards. It is also suitable for use as an inertion agent in explosion suppression applications.

Of the many methods and substances used to prevent and extinguish fires, Context Plus 227 fire protection fluid offers unique advantages over traditional extinguishants. It is safe for people and assets, and it is an environmentally preferred selection.

Safe for people. The EPA and NFPA classify the HFC-227ea as acceptable for use as a total flooding agent in normally occupied spaces. It is characterized by low toxicity.

Safe for assets. Context Plus 227 is electrically non-conductive, non-corrosive, and free of residue. It uses a unique mechanism to absorb the heat energy from combustion reaction thereby, the reaction cannot sustain itself and the combustion cease. Like Halon, Context Plus 227 will completely vaporize and require no clean up after system discharge.

Safer for the environment. Context Plus 227 contains no chlorine or bromine as a result, it does not contribute to the destruction of stratospheric ozone. However, like many fluorine-based gases, the HFC-227ea has a moderate global warming potential.

1.2 Quality Specification

Context Plus 227 quality standards can be summarized as follows:

Purity, % by mole, minimum	:	99.95
Acidity, ppm by weight, maximum	:	3.0
Moisture, % by weight, maximum	:	0.001

1.3 Typical Applications

Context Plus 227 is used as a fire protection fluid in various high value premises that require full room total flooding application, such as data processing centres, electrical rooms, telecommunication switching centres, museum, hospital, airport, engine rooms, mass transit vehicles, storage rooms, libraries, and computer rooms.

1.4 Minimum Design Concentration

Table 1 gives the minimum design concentration required for variety of materials for fire extinguishment. According to NFPA 2001 (2004 edition),

Class A hazard extinguishment is based on a 5.1875% extinguishing concentration. With a 20% safety factor per NFPA 2001 (5.1875 X 1.2 = 6.25%), the minimum design concentration for Class A hazards shall be 6.25%.

For Class B hazards, please refer to the Annex B of NFPA 2001 (2004 Edition) for the cup burner extinguishment concentration value for a particular Class B fuel(s) to be protected. Choose the fuel with the highest cup burner extinguishment value and apply a 30% safety factor (multiply this extinguishment concentration value by 1.3) for the design concentration. The minimum design concentration for the protection of all Class B hazards shall be 8.71% based on the UL2166 total flooding test program.

Table 1: Minimum Design Concentration

Fuel	Concentration % by Volume
Class A	UL 6.25%
Class B	Concentration is determined by fuel test using cup burner method. For details information, please see NFPA 2001 Annex B. Design concentration is determined by the highest cup burner extinguishment value of Class B fuel found within protected hazard. The minimum Class B design concentration shall be UL 8.71%.
Class C	The minimum design concentration for Class C hazards shall be at least that for Class A surface fire.

Note: Effective fire extinguishing requires introducing the concentration of HFC-227ea between 6.25% and 9%. The enclosure temperature has a great influence on the amount of agent needed. The higher the enclosure temperature, the less HFC-227ea agent is required. Conversely, the lower the enclosure temperature, the more HFC-227ea agent is required. This must be taken into account when calculating agent requirements.

1.5 Chemical & Physical Properties

Table 2: Chemical and Physical Properties of Context Plus 227

Properties	Context Plus 227
TRADE NAME	Context Plus 227
ASHRAE DESIGNATION	HFC-227ea
SYNONYM	HFC-227; R-227; Heptafluoropropane; 2-Hydroperfluoropropane; 2-Hydroheptafluoropropane; 2-H-Heptafluoropropane; 1,1,1,2,3,3,3-Heptafluoropropane; Propane,1,1,1,2,3,3,3-Heptafluoro-
MOLECULAR FORMULA	CF_3CHFCF_3
CAS REGISTRY NUMBER	431-89-0
FORM/ODOR	Colorless, odorless, liquefied compressed gas
MOLECULAR WEIGHT	170.03
BOILING POINT	-16.4°C / 2.48°F
MELTING POINT	-131°C / -203.8°F
CRITICAL PRESSURE	422.3 psia
CRITICAL TEMPERATURE	101.7°C / 215.1°F
CRITICAL VOLUME	0.0258 ft^3/lb
CRITICAL DENSITY	38.76 lb/ft^3
CRITICAL COMPRESSIBILITY	0.255
ACENTRIC FACTOR	0.356
DIPOLE MOMENT	1.4309 Debyes
VAPOR PRESSURE @ 21°C/70°F	58.8 psia
VAPOR DENSITY (AIR=1)	6.04
SPECIFIC GRAVITY (H_20=1)	1.46
SPECIFIC HEAT, SATURATED LIQUID @ 25 °C/77°F	0.2820 BTU/lb·°F
SPECIFIC HEAT, SATURATED VAPOR @ 25 °C/77°F	0.2054 BTU/lb·°F
SPECIFIC HEAT, SUPERHEATED VAPOR @ 25 °C/77°F, 1 atm	0.1932 BTU/lb·°F
HEAT OF VAPORIZATION @ B.P.	56.7 BTU/lb
THERMAL CONDUCTIVITY, VAPOR @ 25 °C/77°F	0.0073 BTU/lb·ft·°F
THERMAL CONDUCTIVITY, LIQUID @ 25 °C/77°F	0.0400 BTU/lb·ft·°F
VISCOSITY, VAPOR @ 25 °C/77°F	0.0127 cP
VISCOSITY, LIQUID @ 25 °C/77°F	0.184 cP
SURFACE TENSION @ 25 °C/77°F	7.0 dynes/cm
WATER SOLUBILITY @ 20°C/68°F	260 mg/L
CHEMICAL STABILITY	STABLE

1.6 Environmental Properties

The environmental properties of HFC-227ea and other fire extinguishing agents are given in Table 3. All data were compiled from published sources.

Table 3: Environmental Properties of Fire Extinguishing Agents

Properties	Halon 1211	Halon 1301	HFC-125	HFC-227ea	HFC-236fa
Ozone Depletion Potential[1]	4	12	0	0	0
Global Warming Potential [2]	1,890	7,140	3,500	3,220	9,810
Atmospheric Lifetime (years)	16	65	29	34.2	240
SNAP (Yes/No)	No	No	Yes	Yes	Yes

[1] World Meteorological Organization (WMO) 1998, Model-Derived Method

[2] Intergovernmental Panel on Climate Change (IPCC) 2007 Method, 100-Year ITH

1.7 Thermal Decomposition

The thermal decomposition product (TDP) of primary concern for HFC-227ea is hydrogen fluoride (HF) (ACGIH TLV = 3 ppm). HF is a highly dangerous gas, since it forms a highly corrosive and penetrating hydrofluoric acid upon contact with tissue. Other thermal decomposition products include carbon monoxide and carbon dioxide. Prior to re-entry of a room where the HFC-227ea system has been activated to suppress a fire, air tests must be performed.

There is a direct correlation between the agent discharge time and the amount of TDP created. As a result, the type of fire and the amount of agent exposed to open flame are critical. However, the formation of thermal decomposition products will be minimized by the use of Context Plus early warning detection systems.

Following is a list of safety provisions to prevent personnel from injury when working close to or in the environment protected by Clean Agent systems.

1) Emergency lighting and directional exit signs.
2) Clear aisles and passages for exit routes.
3) Self-closing exit doors that have panic hardware provisions.
4) Continuous alarms during the HFC-227ea discharge and afterward until normal atmosphere have been restored in the area.
5) Alarms within and outside of the area that will operate upon first detection of fire.
6) Warning signs located at the entrances to, and inside the areas, to inform that the HFC-227ea system is installed with instructions that are needed for the particular hazard.

The discharge time of HFC-227ea at 70°F has been established at 10 seconds maximum regardless of the amount discharged. The reasons for the rapid discharge are:

1) Limit the amount of thermal decomposition products generated;
2) Limit fire damage and its effects; and
3) Enhance the mixing.

Note: See Appendix of NFPA–2001, Battery march Park, Quincy, Massachusetts 02169, for further discussion of HFC-227ea Fire Fighting mechanism.

1.8 Materials Compatibility

Context Plus 227 systems shall not be used on fires involving the following materials:

1) Certain chemicals or mixtures of chemicals, such as cellulose nitrate and gunpowder, which are capable of rapid oxidation in the absence of air;
2) Reactive metals, such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium;
3) Metal hydrides; and
4) Chemicals, that is capable of undergoing auto thermal decomposition, such as certain organic peroxides and hydrazine.

1.9 Safety Considerations

The HFC-227ea has been evaluated for cardiac sensitization through test protocols approved by the United States Environmental Protection Agency (EPA). The HFC-227ea has acceptable toxicity and cardiac sensitization levels for use in occupied spaces as specified in the United States EPA Significant New Alternative Policy (SNAP) program rules.

Based on NFPA 2001, the No Observable Adverse Effect Level (NOAEL) for HFC-227ea is 9% and its Lowest Observed Adverse Effect Level (LOAEL) is 10.5%. The NOAEL is the highest concentration that no adverse physiological or toxicological effect has been observed while the LOAEL is the lowest concentration, which an adverse physiological or toxicological effect has been observed.

Consideration shall be given to the possibility of agent migrating to adjacent areas outside the protected space. Care must be taken to insure that the calculated concentration for normally occupied spaces does not exceed the NOAEL.

WARNING: HFC-227ea is discharged through the nozzle orifices. Direct eye or skin contact with the liquid or cold gas can cause chilling or possibly frostbite on exposed tissues. Misuse or intentional inhalation abuse can cause suffocation or death. Do not stand directly in front of the discharge lines as the discharge pressure could cause injury. The nozzles are used to discharge the HFC-227ea in a horizontal direction. The flow of HFC-227ea should not be blocked by any obstructions. Please read and follow the precautions and the safety related information in the Material Safety Data Sheet (MSDS).

1.10 Industry Approvals

Context Plus 227 is Underwriters Laboratories (UL) Listed and Factory Mutual (FM) Approved.

1.11 Material Safety Data Sheet

MSDS NUMBER : CP-00227
REVISION DATE : FEBRUARY 15, 2012

MATERIAL SAFETY DATA SHEET
1,1,1,2,3,3,3-HEPTAFLUOROPROPANE

SECTION 1 – PRODUCT AND COMPANY INFORMATION

TRADE NAME	:	Context Plus 227
SYNONYM	:	HFC-227ea; HFC-227; R-227; Heptafluoropropane; 2-Hydroperfluoropropane; 2-Hydroheptafluoropropane; 2-H-Heptafluoropropane; Propane,1,1,1,2,3,3,3-Heptafluoro-
MOLECULAR FORMULA	:	CF_3CHFCF_3
CAS NUMBER	:	431-89-0
COMPANY	:	CONTEXT PLUS LIMITED 175 MAULDETH ROAD, MANCHESTER M14 6SG ENGLAND, UNITED KINGDOM
PRODUCT USE	:	Fire extinguishing clean agent

PHONE NUMBERS

PRODUCT INFORMATION	:	+44 161 257 2541
EMERGENCY	:	+44 161 257 2541
FACSIMILE	:	+44 161 225 8817
EMAIL	:	CONTEXTPLUS@XPORTSALES.COM

SECTION 2 – COMPOSITION AND INGREDIENT INFORMATION

INGREDIENT NAME	CAS NUMBER	% w/w
1,1,1,2,3,3,3–Heptafluoropropane	431-89-0	≥ 99.96

SECTION 3 – HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW : Misuse or intentional inhalation abuse can cause suffocation or death. Direct eye or skin contact with the liquid or cold gas can cause chilling or possibly frostbite on exposed tissues.

ACUTE HEALTH EFFECTS

EYE CONTACT : Direct eye contact may induce the symptoms for frostbite or cold burns.

SKIN CONTACT : Direct skin contact may induce the symptoms for frostbite or cold burns.

INHALATION : Inhalation may induce the symptoms of headache, nausea, dizziness, loss of consciousness, or cardiac sensitization (irregular pulse or arrhythmia).

INGESTION : No considered as a potential route of exposure.

CHRONIC HEALTH EFFECTS : Not known.

EFFECTS OF REPEATED EXPOSURE : Persons with cardiac, respiratory, or central nervous system disorders may be susceptible to the effects of an over exposure. The use of epinephrine or sympathomimetic drugs may increase susceptibility to cardiac irregularities upon over exposure.

SECTION 4 – FIRST AID MEASURES

EYE CONTACT : Flush/ irrigate with fresh water. Seek medical help.

SKIN CONTACT : Flush/ irrigate with fresh water. Seek medical help if frostbite occurs.

INHALATION : Move to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

INGESTION : No information available.

NOTES TO PHYSICIANS AND FIRST AIDERS: The use of epinephrine or similar compounds can increase susceptibility to heart irregularities caused by over exposure to this compound.

SECTION 5 – FIRE AND EXPLOSION HAZARD

FLASH POINT	:	Not applicable.
FLAMMABLE LIMIT (in air, % by volume)	:	Not applicable.
AUTO – IGNITION TEMPERATURE	:	Not applicable.
EXTINGUISHING MEDIA	:	All conventional media are suitable.
UNUSUAL FIRE AND EXPLOSION HAZARDS	:	Although containers are provided with pressure and temperature relief devices, containers can rupture if exposed to localized heat. Thermal decomposition products may be toxic or corrosive.
SPECIAL FIRE FIGHTING PROCEDURES	:	Apply water spray from a safe distance to prevent possible container rupture. Use a self-contained breathing apparatus if containers rupture. Thoroughly ventilate affected area to remove product and any decomposition products before allowing re-entry.
PRODUCTS OF COMBUSTION	:	High temperature in a fire condition or glowing metal surfaces may generate hazardous decomposition products, which include hydrogen fluoride (ACGIH TLV = 3 ppm), carbon monoxide, carbon dioxide, and others.

SECTION 6 – ACCIDENTAL SPILL/RELEASE/LEAK MEASURES

ACCIDENTAL SPILL/RELEASE OR LEAK PROCEDURES	:	Evacuate and ventilate affected area. Prohibit general entry into areas where high concentrations may exist (especially confined or poorly ventilated areas). Note that the compound vapors are denser than air and thus the concentrations will be higher at lower levels.
PERSONAL PRECAUTIONS	:	Use appropriate personal protective equipment including self-contained breathing apparatus when entering the affected areas.

SECTION 7 – PRECAUTION IN HANDLING AND STORAGE

HANDLING	:	Practice precautions as would be used in handling any cryogenic gas.

STORAGE	:	Store in a cool, dry, well-ventilated area, and separate these products from other incompatible materials. Protect container from possible damage and keep container tightly closed. When use as fire fighting agent in fixed or portable extinguishing systems, follow equipment manufacturer's instructions for operation, inspection, maintenance, and repair of the system.

SECTION 8 – EXPOSURE CONTROLS AND PERSONAL PROTECTION

VENTILATION	:	Passive ventilation (windows, doors, etc.) is generally adequate for small areas. Mechanical ventilation for areas used in large storage and filling facilities.
RESPIRATORY PROTECTION	:	Wear NIOSH/MSHA approved self-contained breathing apparatus.
EYE/FACE & SKIN PROTECTION	:	Use chemical splash goggles to protect eye & face when handling product. Use cryogenic gloves if handling liquid. Use protective clothing designed to minimize skin contact.
WORK HYGIENIC PRACTICES	:	Be prudent in confined space. As with all chemical products, wash thoroughly after handling. Wash contaminated clothing before re-use.

SECTION 9 – PHYSICAL AND CHEMICAL CHARACTERISTICS

GENERAL	:	Colorless, odorless liquefied gas
MOLECULAR WEIGHT	:	170.03
BOILING POINT	:	-16.4°C / 2.48°F
VAPOR PRESSURE @ 21°C/70°F	:	58.8 psia
VAPOR DENSITY (AIR=1)	:	6.04
WATER REACTIVE	:	NO
SPECIFIC GRAVITY (H_20=1)	:	1.46
PERCENT VOLATILE (by volume)	:	No information available.
EVAPORATION RATE (Butyl acetate = 1)	:	No information available.
VISCOSITY @ 20°C/68°F	:	No information available.
MELTING POINT	:	-131°C / -203.8°F
WATER SOLUBILITY @20°C/68°F	:	260 mg/L
CRITICAL TEMPERATURE	:	101.7°C / 215.1°F
CRITICAL PRESSURE	:	422.3 psia

SECTION 10 – STABILITY AND REACTIVITY

CHEMICAL STABILITY	:	Stable under normal storage condition and temperature.
CONDITIONS TO AVOID	:	Avoid source of heat and open flame.
INCOMPATIBLE MATERIALS	:	Strong reducing agent, such as alkali metals (e.g. sodium, potassium), alkali – earth metals (e.g. magnesium, calcium), powdered metals (e.g. aluminum, magnesium or zinc), and most halogenated organic compounds.
HAZARDOUS DECOMPOSITION PRODUCTS	:	Thermal decomposition may produce hydrogen fluoride, carbon monoxide, and carbon dioxide.
HAZARDOUS POLYMERIZATION	:	Will not occur.

SECTION 11 – TOXICOLOGICAL INFORMATION

TOXICITY DATA

INGREDIENT NAME	TEST	RESULT	ROUTE	SPECIES
1,1,1,2,3,3,3-Heptafluoropropane	LC_{50}	> 788,698 ppm for 4 hours	Inhalation	Rats

SECTION 12 – ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE

ATMOSPHERIC LIFETIME (IN YEARS)	:	34.2 years
OZONE DEPLETION POTENTIAL (R-11 = 1)	:	0
GLOBAL WARMING POTENTIAL (CO_2 = 1)	:	3,220 for a 100-year time horizon

ECO-TOXICITY

No information available.

SECTION 13 – DISPOSAL CONSIDERATIONS

WASTE DISPOSAL	:	Product may be reclaimed if not contaminated. All disposals should be in accordance with the local authority having jurisdiction, generally by incineration at an accredited facility with appropriate scrubber and emission control process.

SECTION 14 – TRANSPORT INFORMATION

U.S.DOT

PROPER SHIPPING NAME	:	Heptafluoropropane or refrigerant gas R-227
HAZARD CLASS	:	2.2 Non-flammable gas
UN NUMBER	:	UN3296

AIR TRANSPORT - ICAO OR IATA

PROPER SHIPPING NAME	:	Heptafluoropropane or refrigerant gas R-227
HAZARD CLASS	:	2.2 Non-flammable gas
UN NUMBER	:	UN3296

WATER - IMDG

PROPER SHIPPING NAME	:	Heptafluoropropane or refrigerant gas R-227
HAZARD CLASS	:	2.2 Non-flammable gas
UN NUMBER	:	UN3296

SECTION 15 – REGULATORY INFORMATION

U.S. Federal Regulations

Toxic Substance Control Act (TSCA) Inventory: Listed

SARA Title III Hazard Classifications under Sections 311 and 312

Fire	:	No
Sudden Release of Pressure	:	No
Reactive	:	No
Acute	:	Yes
Chronic	:	No

SECTION 16 – OTHER INFORMATION

NFPA CODES

HEALTH	=	1
FLAMMABILITY	=	0
REACTIVITY	=	1

HMIS CODES

HEALTH	=	1
FLAMMABILITY	=	0
REACTIVITY	=	0
PROTECTION	=	x

HAZARD INDEX

0 = MINIMAL HAZARD, 1 = SLIGHT HAZARD, 2 = MODERATE HAZARD, 3 = SERIOUS HAZARD, 4 = SEVERE HAZARD, x = DEPENDING ON THE USE CONDITIONS

NOTICE TO READER

Context Plus Limited urges each customer or recipient of this MSDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this MSDS and any hazards associated with the product. The above information is provided in good faith and believed to be accurate, but does not claim to be all inclusive. Since conditions for use of the product are not under the control of the company, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Users should consider these data only as a guide to the appropriate precautionary and emergency handling of the product. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here is based on data available at the time of shipping, is subject to change without notice as new information is obtained, and may not be valid for such material used in combination with any other material or in any process. However, no warranty of any kind, express or implied, is given.

2 System Hardware

2.1 Introduction

The Context Plus Engineered HFC-227ea Systems, as outlined in this manual, are those that are intended to be designed and installed to protect single or multiple hazards within the limitations tested by a recognized testing agency as stated in this manual ONLY. Authorities Having Jurisdiction (AHJ) should follow the information specified by the Standard on Clean Agent Extinguishing Systems NFPA 2001. The equipment described in this manual is listed by Underwriters Laboratories, Inc. in accordance to the Standard for Halocarbon Clean Agent Extinguishing System Units (UL 2166). Our total flooding fire extinguishing systems are the first and only one in the world that are UL listed to utilize the HFC-227ea from Context Plus 227 (Context Plus Limited), FE-227/FM-200 (Dupont), and Chemori 227™ (Chemori Americas) under UL File EX 15295.

2.2 Cylinders

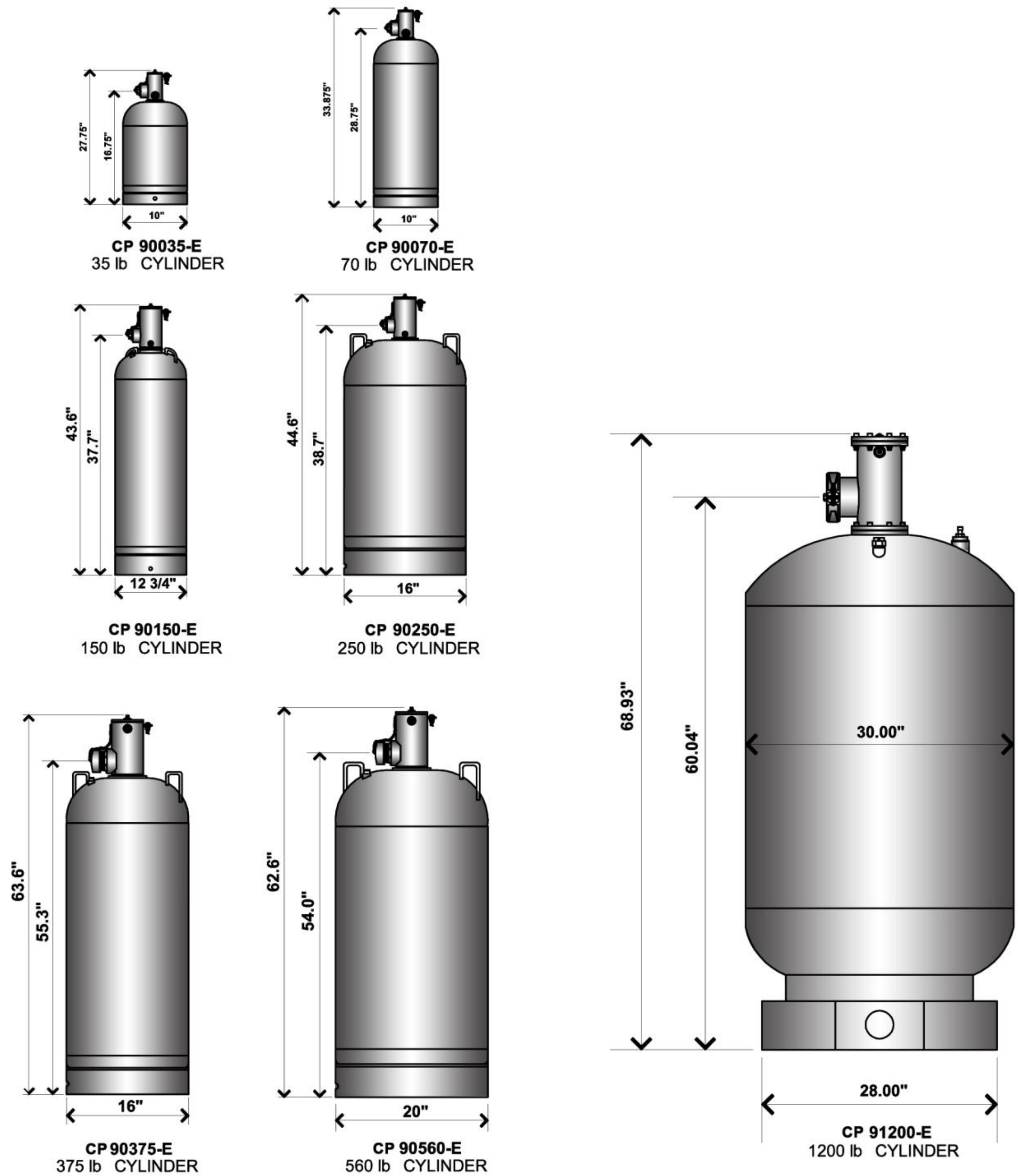
The Engineered Clean Agent System Cylinders are available in the following capacities: 35 lb., 70 lb., 150 lb., 250 lb., 375 lb., 560 lb., and 1200 lb. Each of the basic sizes can be filled with one pound increment to meet the exact amount of HFC-227ea required, within their fill ranges (Table 4).

Table 4: Fill Range of the Cylinders

Part Number	Cylinder Size	Max. Fill at 70 lb/ft^3	Min. Fill at 30 lb/ft^3
CP90035-E	35 lb	35 lb	16 lb
CP90070-E	70 lb	71 lb	31 lb
CP90150-E	150 lb	152 lb	69 lb
CP90250-E	250 lb	253 lb	109 lb
CP90375-E	375 lb	379 lb	163 lb
CP90560-E	560 lb	561 lb	241 lb
CP91200-E	1200 lb	1211 lb	519 lb

System temperature limits are 32˚F (0 ˚C) to 130˚F (54.4˚C) and system operating pressure is 360 psi (25.3 kg_f/cm^2) at 70˚F (21.1˚C). The cylinders are manufactured, tested, and stamped in accordance to DOT 4BW500 or DOT 4BA500. The dimension of each cylinder is provided in Figure 1.

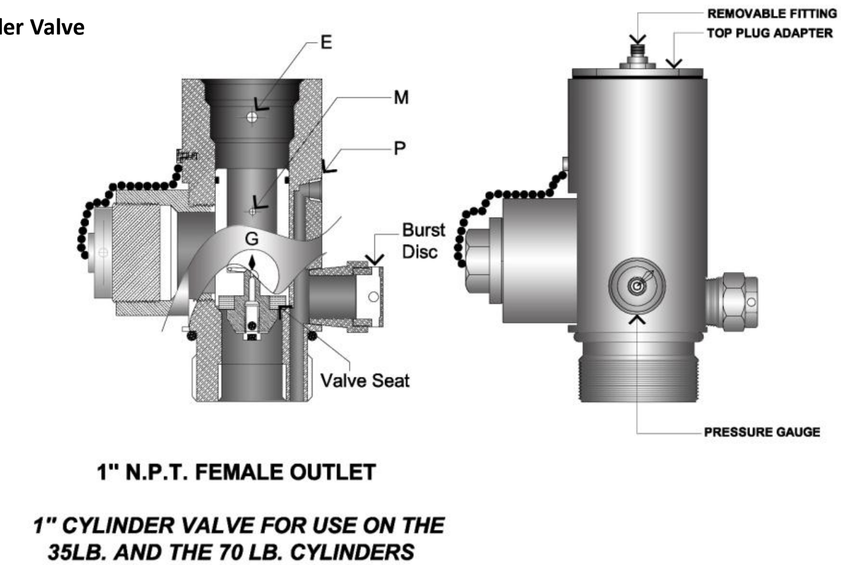
Figure 1: Cylinder and Valve Assembly



2.3 Cylinder Valves

The cylinder valves are back pressure type valves. A piston in the valve is equipped with a rubber seal that keeps the HFC-227ea Clean Agent under pressure within the cylinder. A small hole in the piston allows cylinder pressure to be equalized on both sides of the piston. Since the area at the top of the piston is greater than the area at the bottom of the piston, the net force seals the piston against the valve discharge outlet. When the cylinder pressure on the top of the piston is relieved by means of automatic or manual actuation, there is only cylinder pressure acting against the piston seal, and the piston slides to its full open position, allowing cylinder discharge through the distribution network.

Figure 2: 1 - Inch Cylinder Valve



The 35 lb. and 70 lb cylinders are equipped with 1 inch valve (Figure 2). The 150 lb and 250 lb cylinders are equipped with 1½ inch valve (Figure 3). The 375 lb and 560 lb cylinders are equipped with 2 ½ inch valve (Figure 4). The 1200 lb cylinder is equipped with 4 inch valve (Figure 5).

Figure 3: 1 ½ - Inch Cylinder Valve

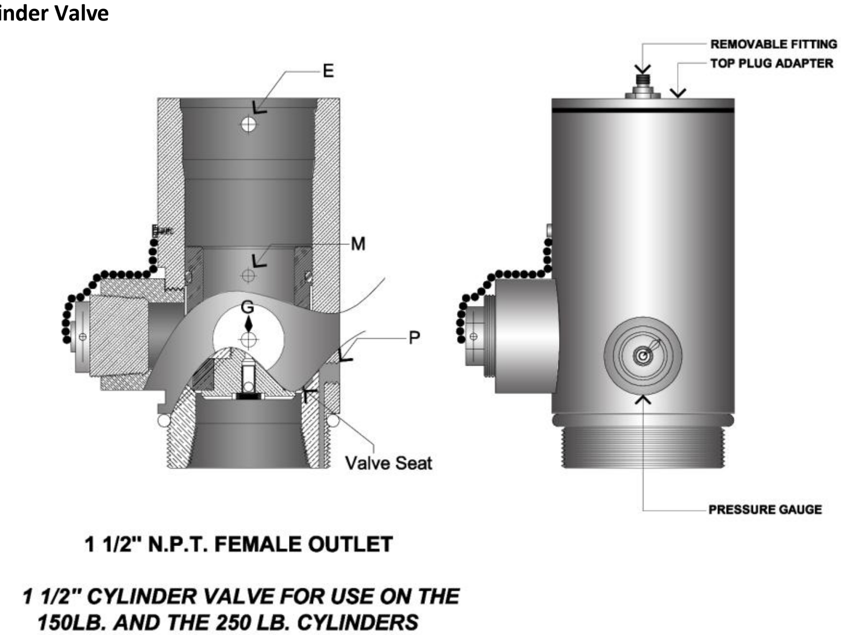
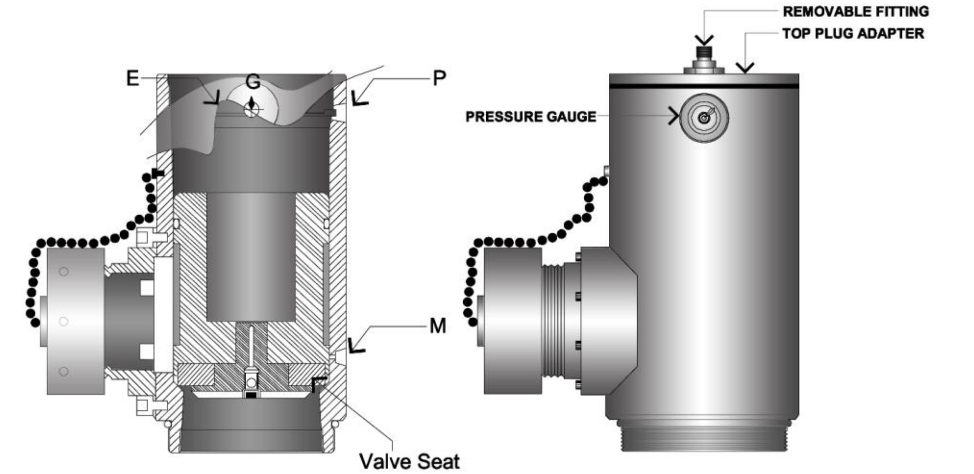


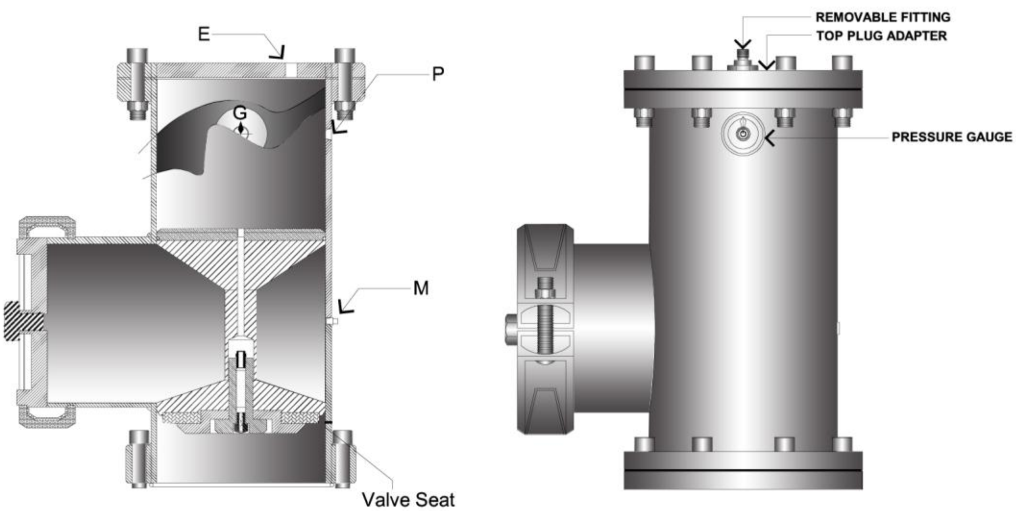
Figure 4: 2 ½ - Inch Cylinder Valve



2 1/2" N.P.T. MALE OUTLET

2 1/ 2" CYLINDER VALVE FOR USE
ON THE 375 LB AND 560 LB CYLINDER

Figure 5: 4 - Inch Cylinder Valve



4" N.P.T. VICTAULIC OUTLET

4" CYLINDER VALVE FOR USE
ON THE 1200 LB LB CYLINDER

CAUTION: All cylinder valves are factory equipped with anti-recoil device. The anti-recoil device MUST be attached to the valve outlet at all times, unless the outlet is connected to the discharge piping or recharge adapter.

NOTE: 'P' represents the port for Pressure Supervisory Switch. 'E' represents the port for Electric Solenoid. 'G' represents the port for Pressure Gauge. 'M' represents the port for hose connection to Pneumatic Piston Actuator or Pressure Operated Switch.

Attached to the bottom of the cylinder valve is the siphon tube, which is straight and runs from the top of the cylinder to the bottom of the cylinder. The cylinders must be installed in an upright position (valve on top).

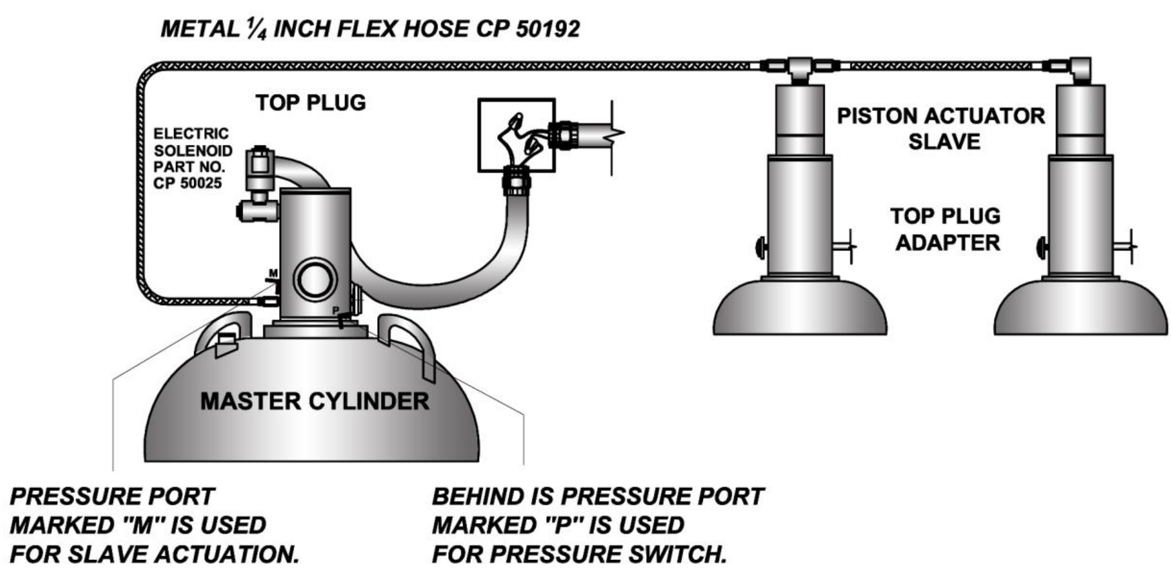
Port P - 1/8" NPT

Located on the cylinder valve is a 1/8" NPT outlet stamped "P". The outlet transmits cylinder pressure to an optional low pressure supervisory switch, which monitors the internal pressure of the cylinder. The low pressure supervisory switch is installed into the port marked "P". In order to install the pressure switch, the cylinder must be emptied with no pressure. This is done at the factory before filling and pressurizing.

Port M - 1/8" NPT

Another 1/8" NPT outlet stamped "M" on the cylinder valve is available for use as a pressure source to drive the piston actuators on a multiple cylinders system or to actuate a pressure operated switch in the event of the cylinder discharge. The 1/8" NPT plug used for port "M" can be removed at any time. It will not see pressure until the system is discharged.

Figure 6: Pressure Port M for Use with Piston Actuators



2.4 Cylinder Brackets

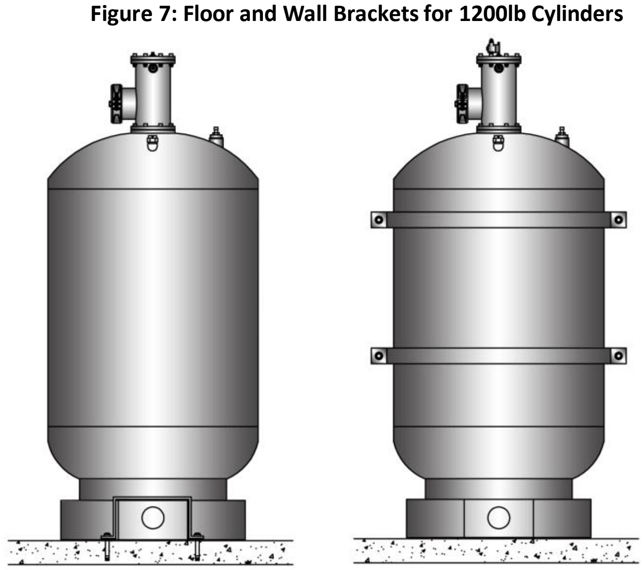
The cylinder brackets are manufactured from stainless steel band. They are formed to the radius of the cylinder with flanges for bolting and to continuous slot metal framing channel (12-gauge steel with corrosion-resistant paint or galvanized 1100 H Unistrut). The channel is to be supplied by the installer. The cylinder bracket must be secured to a surface such that the bracket will withstand a load up to 5 times of the cylinder weight. This precaution is to have the bracket safely supports the weight of the cylinder and the reaction force of the HFC-227ea Clean Agent when discharge.

One cylinder bracket is required for the 35 lb, 70 lb, 150 lb, and 250 lb cylinders. For the 375 lb, 560 lb, and 1200 lb cylinders, two bracket straps should be used. All cylinders must be mounted vertically only, with valve up, resting firmly on the floor, as shown in Figure 7 and 8. The dimensions of the cylinder brackets are given Table 5.

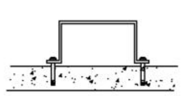
Table 5: The Dimensions (in Inches) of the Cylinder Brackets

Cylinder Part No.	Cylinder O.D.	Bracket Part No.	A	B	C	D	E	F	Mounting
CP90035-E	10.00”	CP50139	9.875”	13.25”	11.75”	1.5”	4.75”	2”	Wall
CP90070-E	10.00”	CP50139	9.875”	13.25”	11.75”	1.5”	4.75”	2”	Wall
CP90150-E	12.75”	CP60780	12.50”	16.00”	14.50”	1.5”	6.50”	2”	Wall
CP90250-E	16.00”	CP60760	15.93”	19.25”	17.75”	1.5”	7.75”	2”	Wall
CP90375-E	16.00”	CP60760	15.93”	19.25”	17.75”	1.5”	7.75”	2”	Wall
CP90560-E	20.00”	CP60770	19.93”	23.25”	21.75”	1.5”	9.75”	2”	Wall
CP91200-E	30.00”	CP60790	29.13”	33.25”	31.75”	1.5”	14.00”	2”	Wall
CP91200-E	30.00”	CP60772	4.500”	11.50”	10.00”	1.5”	N/A	2”	Wall

Figure 7: Floor and Wall Brackets for 1200lb Cylinders



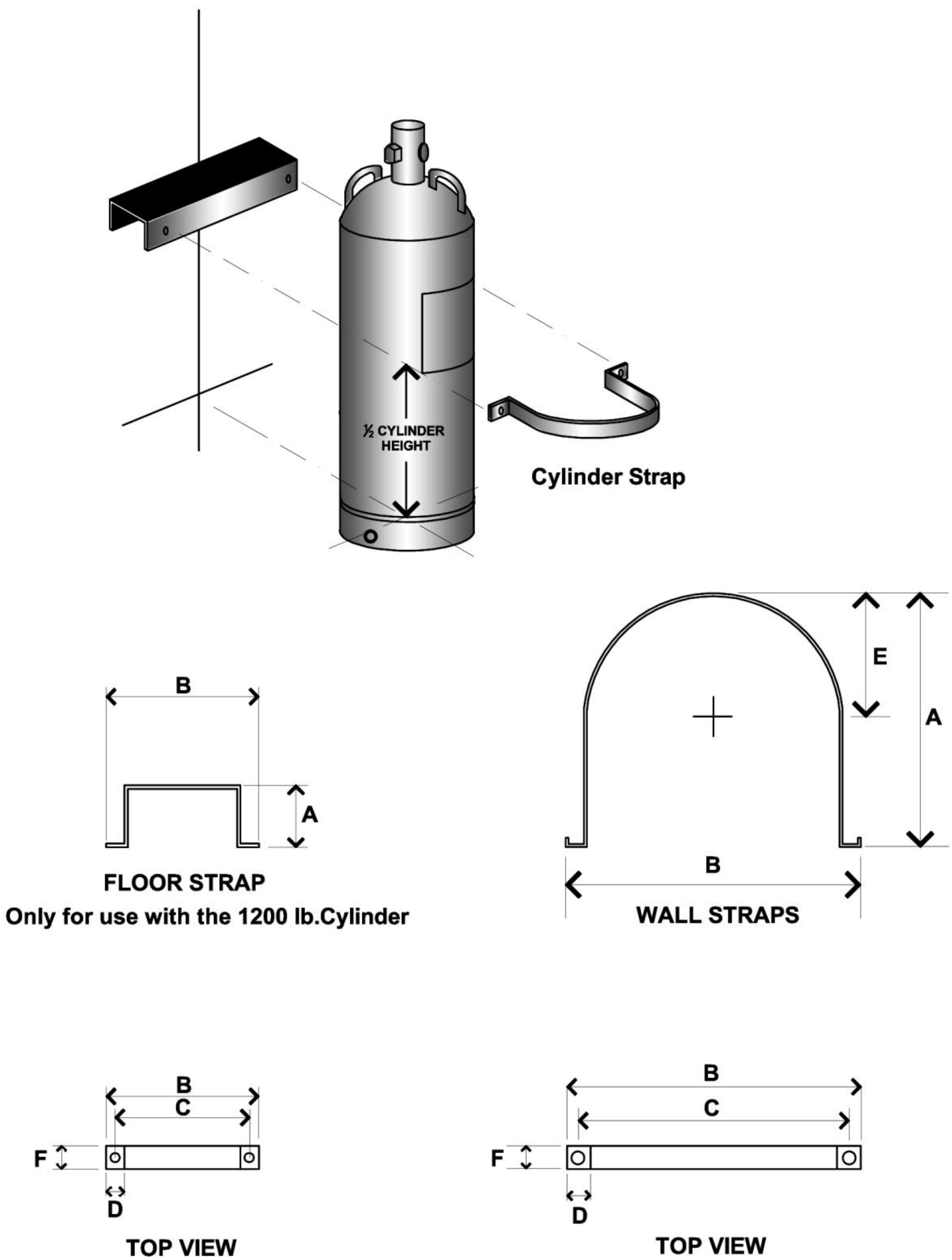
Floor Mount Bracket
Part No. CP 60772
Note: Requires 2 Brackets





Wall Mount Bracket
Part No. CP 60790
Note: Requires 2 Brackets

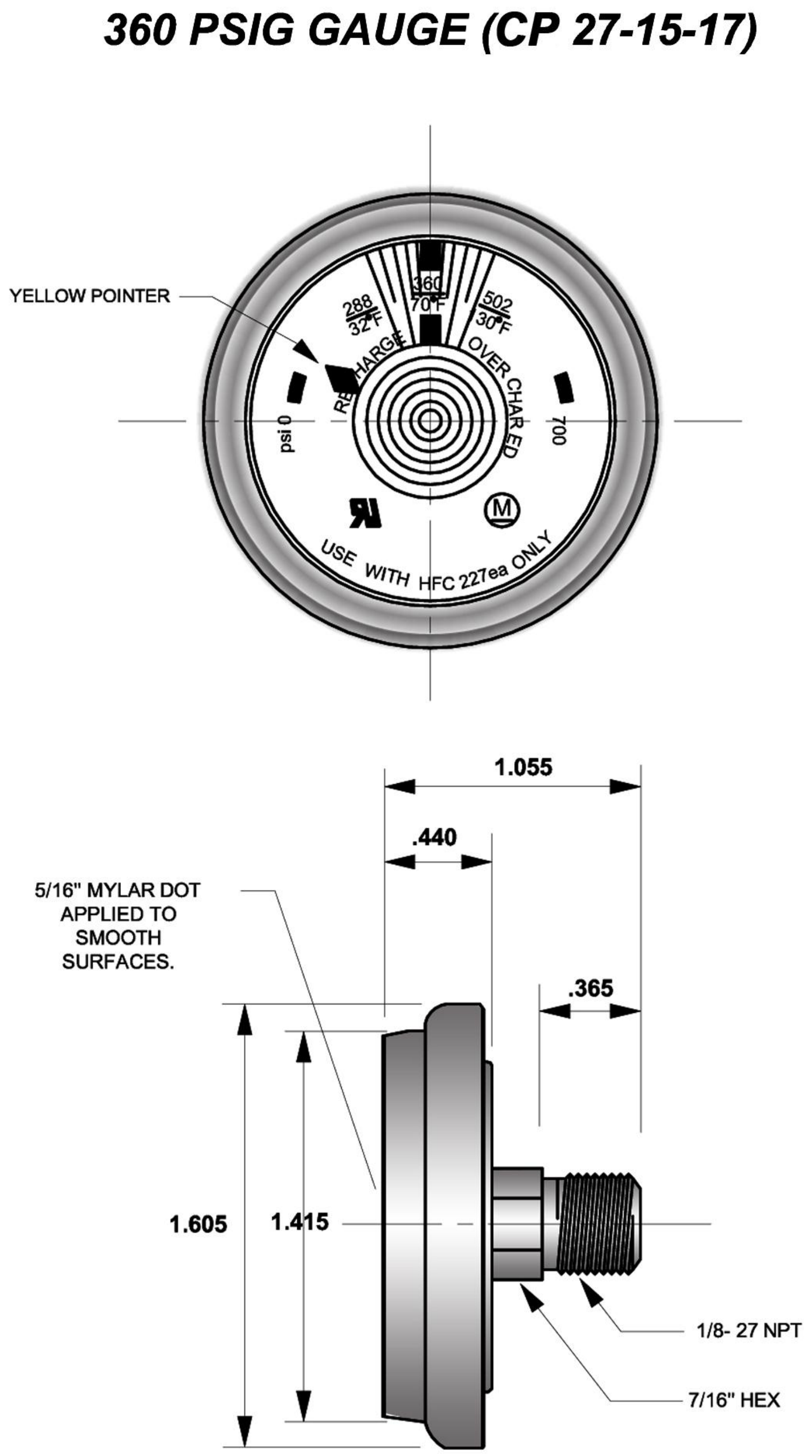
Figure 8: Cylinder Brackets



2.5 Pressure Gauges

Pressure gauge mounts directly to the 1/8" NPT outlet stamped "G" on the cylinder and is used to monitor the internal pressure of the cylinder. They are available in 240 psig and 360 psig.

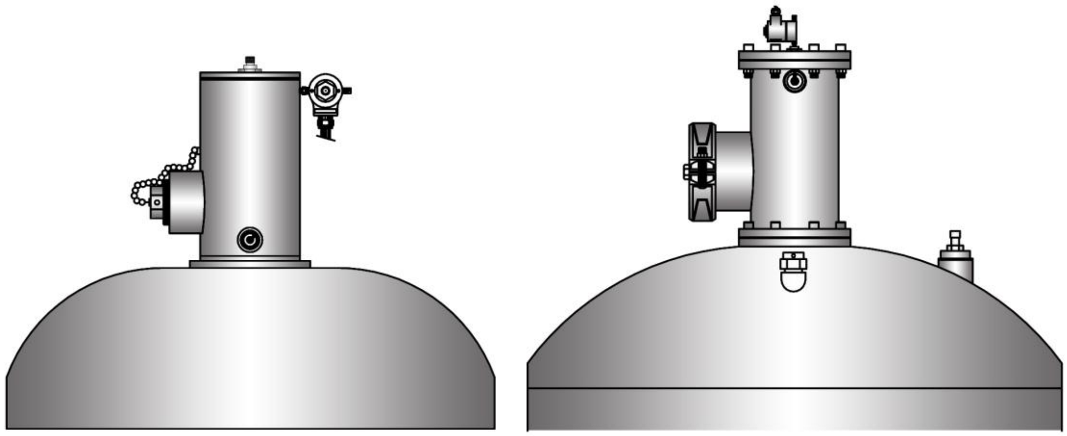
Figure 9: Pressure Gauges



2.6 Cylinder Valve Controls

The 11 Watts Electric Solenoid, the Local Manual Control, and the Piston Actuator can be used for the 1”, 1 ½”, and 2 ½” valves. The 4” valve requires the 15 Watts Electric Solenoid (Figure 10).

Figure 10: 11 Watts and 15 Watts Electric Solenoids



11 Watts Electric Solenoid

15 Watts Electric Solenoid

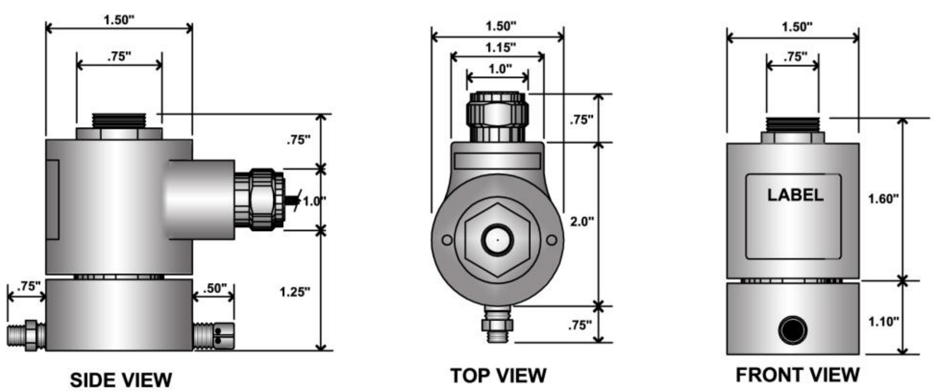
2.6.1 Electric Solenoid

The Electric Solenoid valve is normally closed, and the valve requires electrical energy to remain open. It is used to vent the pressure from the top of the piston in the cylinder valve, allowing the piston to slide upward and commence cylinder discharge. The Electric Solenoid valve is available in 24 VDC (see Table 6). The source of the electrical energy will determine the number and rating of the electrical solenoids used.

Table 6: Part Numbers of Electric Solenoid

Electric Solenoid Part Number	Electrical Rating
CP 50025-2	24 VDC, 11 Watts
CP 50025-6	24 VDC, 15 Watts

Figure 11: Electric Solenoid



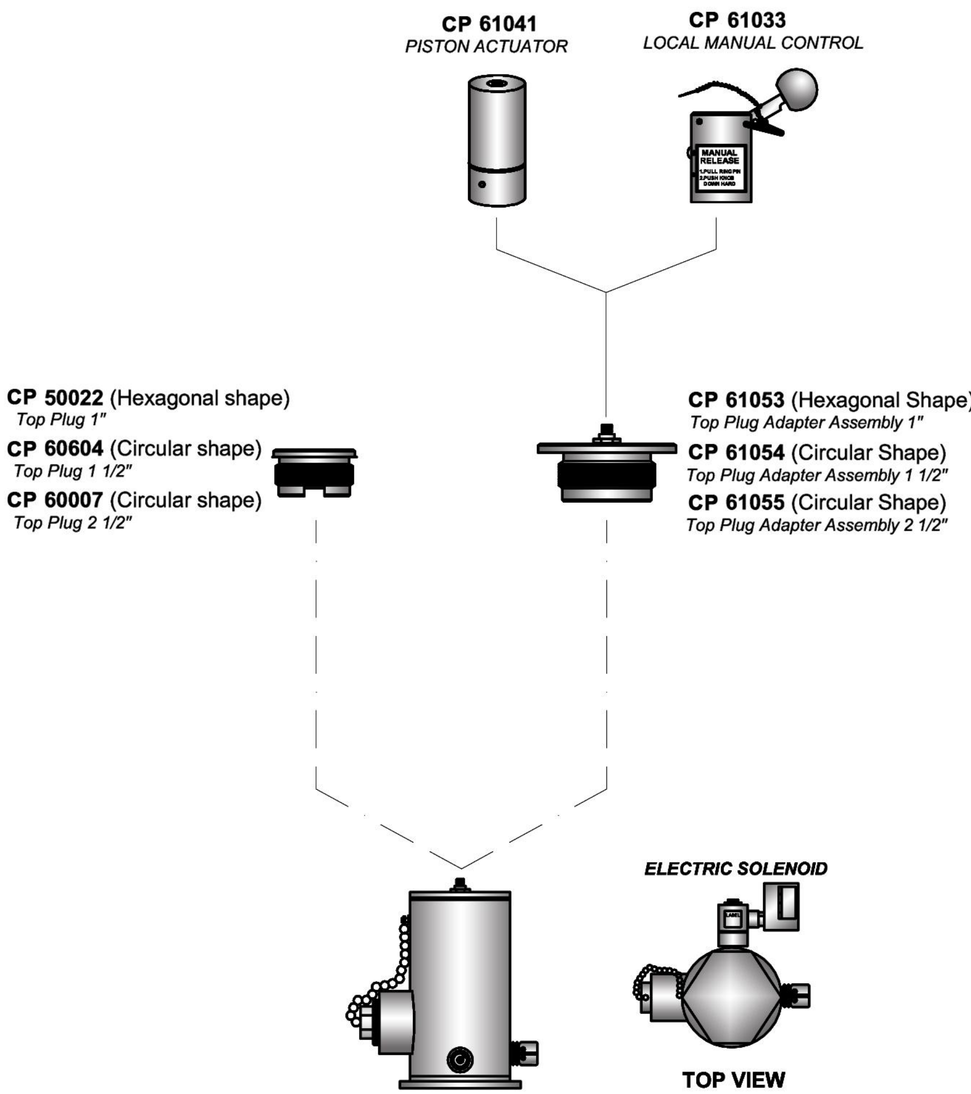
Prior to wiring the solenoid to the actuation circuit, make sure that the solenoid rating matches the actuating circuit voltage. Connect solenoid pigtails to the actuation circuit wires with wire nuts within a junction box or by means designated by the authorities having jurisdiction.

Whenever the Electric Solenoid is used as sole means of actuation, a top plug must be used to seal the top of the cylinder valve. Otherwise, a top plug adapter must be applied. See Figure 12 for details.

CAUTION:

1. **The 24 VDC solenoid circuit must be supervised for a break in the wiring, a ground, or a short circuit.**
2. **Do not electrically activate the solenoid during the filling operation or at any time unless the discharge valve outlet has the anti-recoil fitting installed or the discharge piping is installed.**

Figure 12: Use of Top Plug Adapter and Top Plug

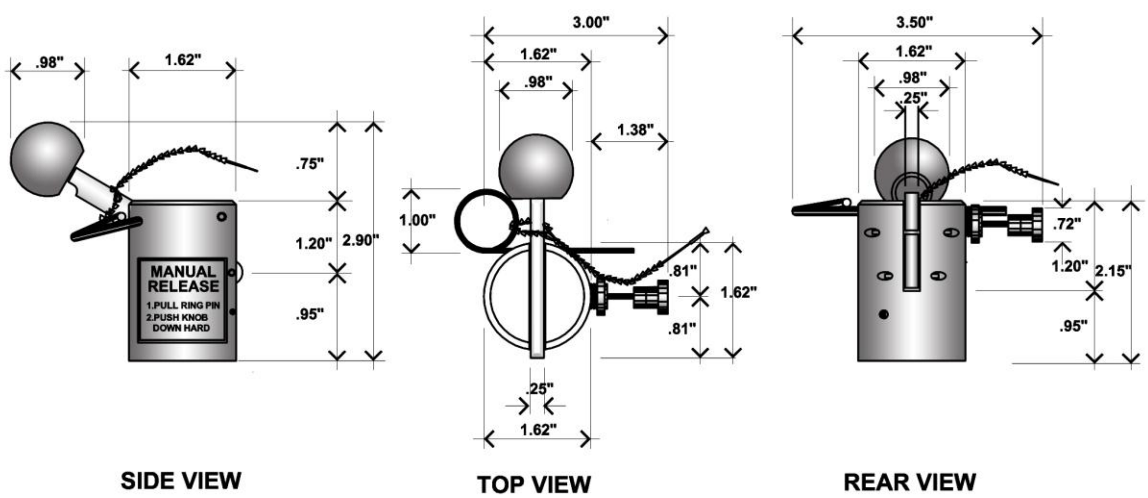


The discharge valve equipped with a solenoid valve is actuated from the UL Listed Control Panel for releasing device service and is compatible with Context Plus equipment. A suitable Control Panel shall be specifically UL Listed for releasing device service and/or approved for use with the Electric Solenoid releasing device for Context Plus discharge valves. For FM applications, the control panel must have FM Approval. The Control Panel shall be provided for supervision of the releasing circuits per NFPA requirements. In addition, 24-hour batteries backup power supply as well as both manual and automatic releasing capabilities shall be provided per NFPA requirements.

2.6.2 Local Manual Control Head

The Local Manual Control Head (Part Number: CP 61033) features a local lever driven push rod that depresses a Schrader Check Valve, thereby venting the pressure from the top of the piston in the cylinder valve. This allows the piston to slide upward and commence cylinder discharge. The Local Manual Control mounts directly to a top plug adapter, which is located on top of the cylinder valve.

Figure 13: Local Manual Control Head





CAUTION:

1. **Be sure the safety pull-pin is installed in the control/operating lever of the cylinder at all times. Ensure that the safety pull-pin is correctly installed until system is activated by use of the local manual control.**
2. **When reinstalling the Local Manual Control Head back onto the Top Plug Adapter, you must ensure that the lock-pin is reset with the handle in the up position. Failure to reset the control head before installation will result in the unwanted discharge of the system during installation. Pulling out the lock-pin, and at the same time, lifting the handle to reset it. The pull-pin and plastic seal should be in place at all times when the control is not in use.**

2.6.3 Piston Actuator

The Piston Actuator (Part Number: CP 61041) features a pneumatically driven piston that depresses a Schrader Check Valve, thereby venting the pressure from the top of the piston in the cylinder valve, allowing the piston to slide upward and commence cylinder discharge. The pneumatic pressure required to operate the Piston Actuator is obtained from the "M" port of the master cylinder. The Piston Actuator mounts directly to a Top Plug Adapter, which is located on top of the cylinder valve.

Multiple cylinders equipped with Piston Actuators can be activated from one master cylinder using 1/4" copper tubing (installer furnished) or 1/4" metal flex hose. The type K copper tubing that has an O.D. of 1/4" and a nominal I.D. of 1/8″I.D. is acceptable and adherence to the ASTM-280. The maximum number of Piston Actuators that are allowed for manifold applications is provided in Table 7 and Figure 15.

Figure 14: Piston Actuator

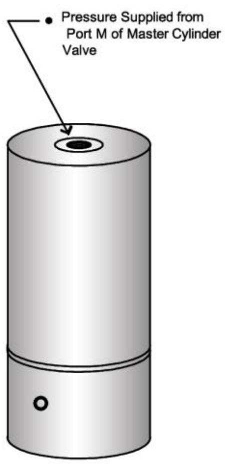


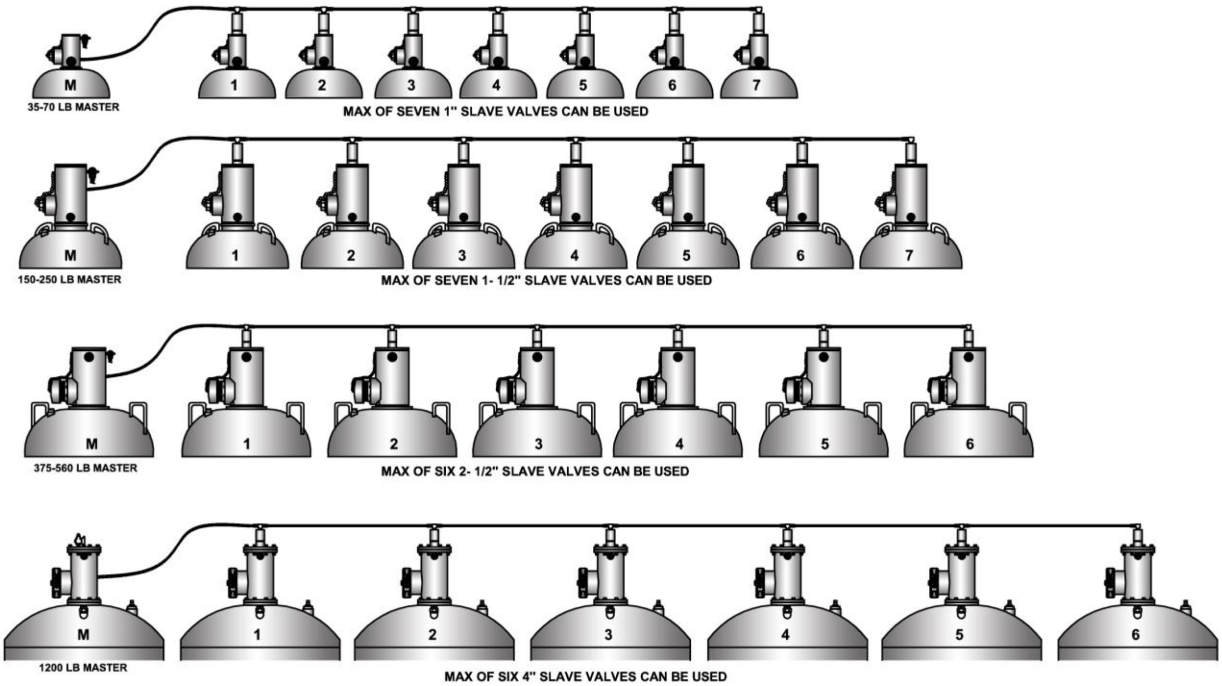
Table 7: Maximum Allowable Number of Piston Actuators for Manifold Applications

Cylinder Size	Valve Size	Max. Number of Piston Actuators	Total Length of Copper Tubing
35 lb.	1"	7	50 ft
70 lb.	1"	7	50 ft
150 lb.	1 ½ "	7	50 ft
250 lb.	1 ½ "	7	50 ft
375 lb.	2 ½ "	6	30 ft
560 lb.	2 ½ "	6	30 ft
1200 lb.	4"	6	30 ft

NOTE:

1. **Tubing specifications must adhere to ANSI H23.5 and ASTM B280.**
2. **When using the 1/4" metal flex hose CP 50192 (20"), CP 50192-1 (24"), CP 50192-2 (36"), the length of the flex hose is to be subtracted from total length of copper tubing in Table 7 to determine the maximum length of copper tubing that can be used. At no time may the total length of copper tubing and the flex hose exceed the stated lengths under Table 7.**

Figure 15: Maximum Number of Piston Actuators



The configuration options for the 4" valve are given in Figures 16, 17, 18 and 19.

Figure 16: Piston Actuator on 4" Valve

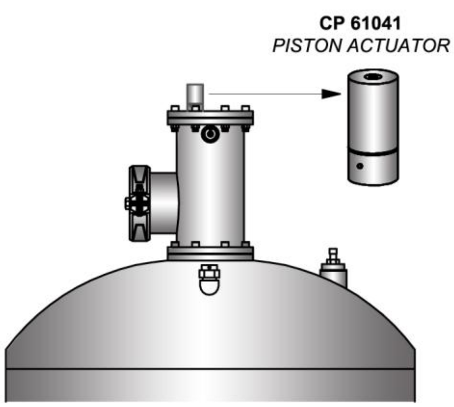


Figure 17: Electric Solenoid on 4" Valve

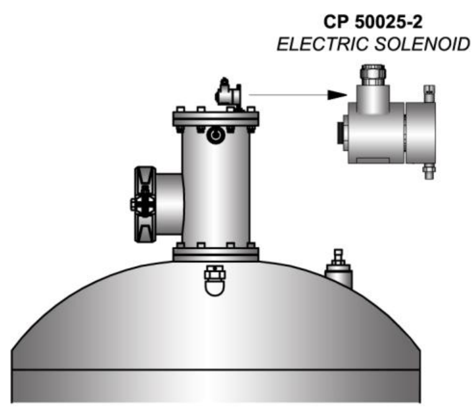


Figure 18: Electric Solenoid and Local Manual Control Head on 4" Valve

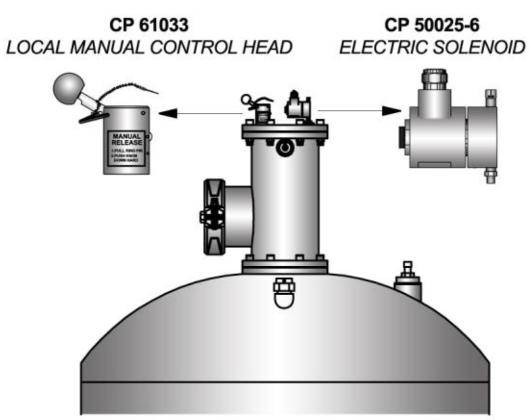
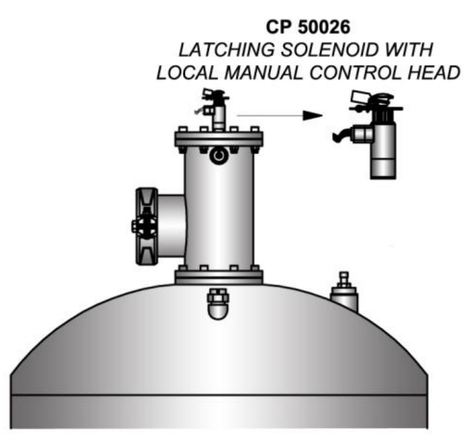


Figure 19: Latching Solenoid on 4" Valve

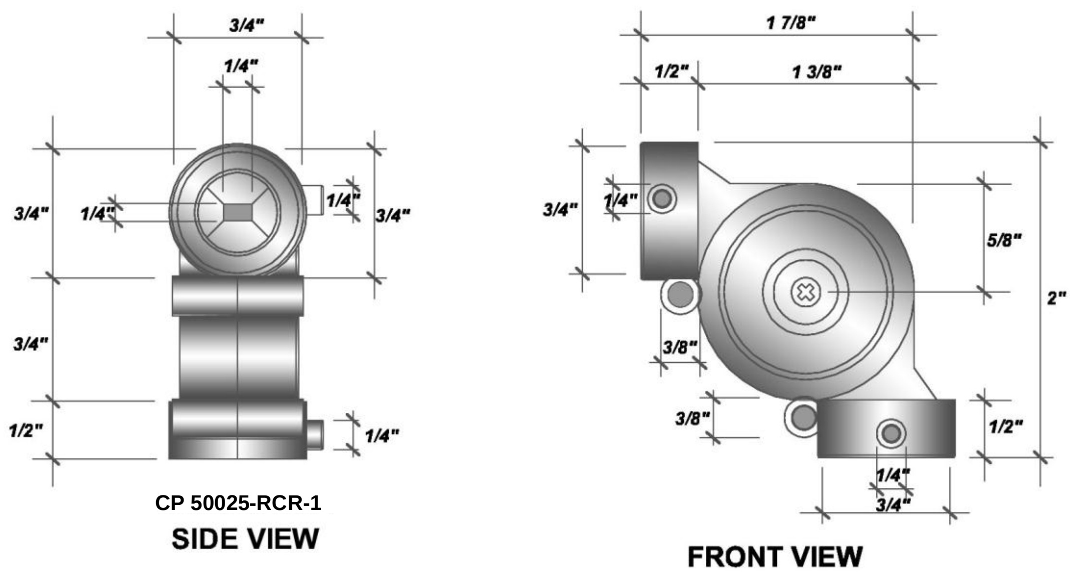


2.6.4 Manual Cable Release

2.6.4.1 Pulley and Pull Box

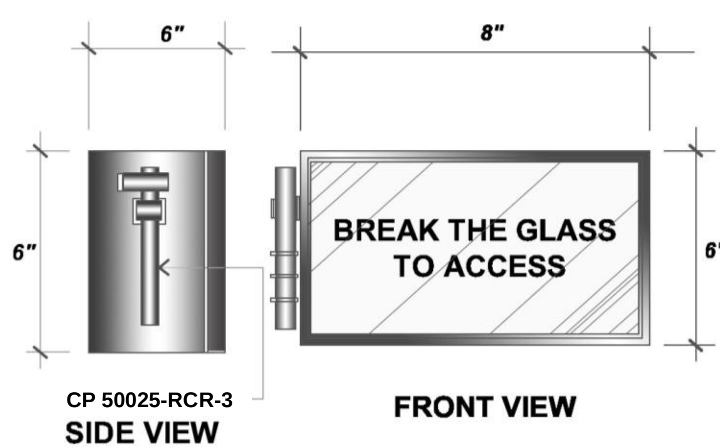
The corner pulley is required on a clean agent fire extinguishing system whenever a remote pull box cable requires a change in direction. Corner pulleys are installed as part of the cable housing (pipe) and provides a 90 degree directional change with minimal loss of force and eliminates cable kinking. The pulleys are made from a high quality alloy with a steel wheel that rotates on a cartridge ball bearing and can be used in high temperature environments. Up to fifteen pulley can be used per pull box as long as the total cable length does not exceed 20 metres.

Figure 20: Pulley



A pull box is required when a remote manual release is required. A single pull box can be used to activate single or multiple cylinder fire extinguishing systems. The pull handle is securely and safely stored behind a glass pane, requiring a minimum of two separate actions to activate the system. The glass can be easily broken via the attached hammer for easy access in emergency situations. The pull handle is also secured in the pull box with a tamper seal to ensure there are no accidental discharges.

Figure 21: Pull Box



2.6.4.2 *Cylinder Valve Fire Extinguishing System with Manual Cable Release*

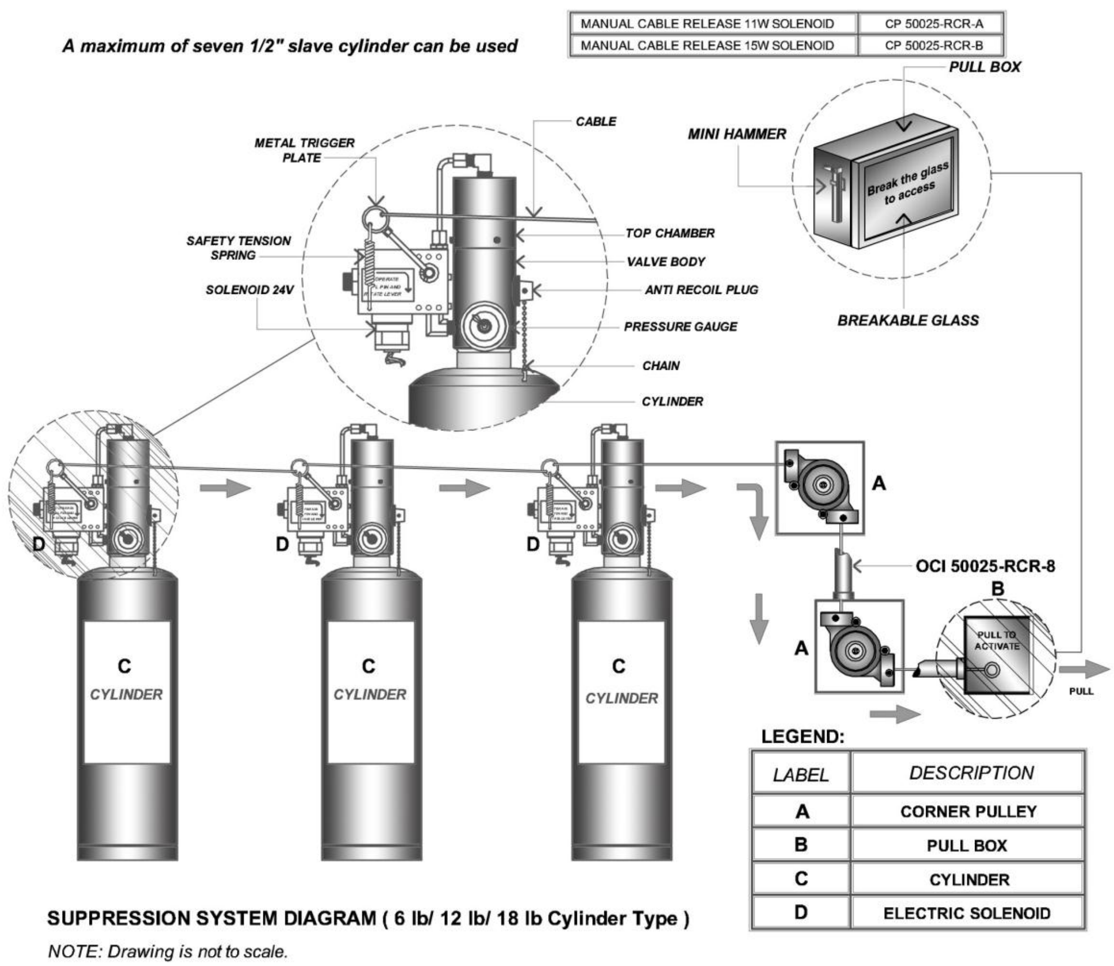
The manual cable release is connected to the manual release of the electric solenoid. The cables are securely held in place via a safety retaining spring and tamper seal. The cables are routed to the remote pull box via Context Plus corner pulleys and conduit so as to maintain proper tension, protect the cable whilst eliminating cable kinking. The manual cable release can be used for single or multiple cylinder fire extinguishing systems. For multiple cylinder systems, cylinders must be aligned linearly if attached in series via a cable.

Alternatively, if more complex geometries required, Context Plus Piston Actuators can be used in conjunction with the manual cable release to open the subsequent cylinders. (Except for ½”valve).

Table 8: Maximum Number of Slave Cylinders for Fire Extinguishing System with Manual Cable Release

Valve Size	Max. Number of Slave Cylinders
½ ”	7
1”	7
1 ½ ”	7
2 ½ ”	6

Figure 22: 1/2” Valve System with Manual Cable Release



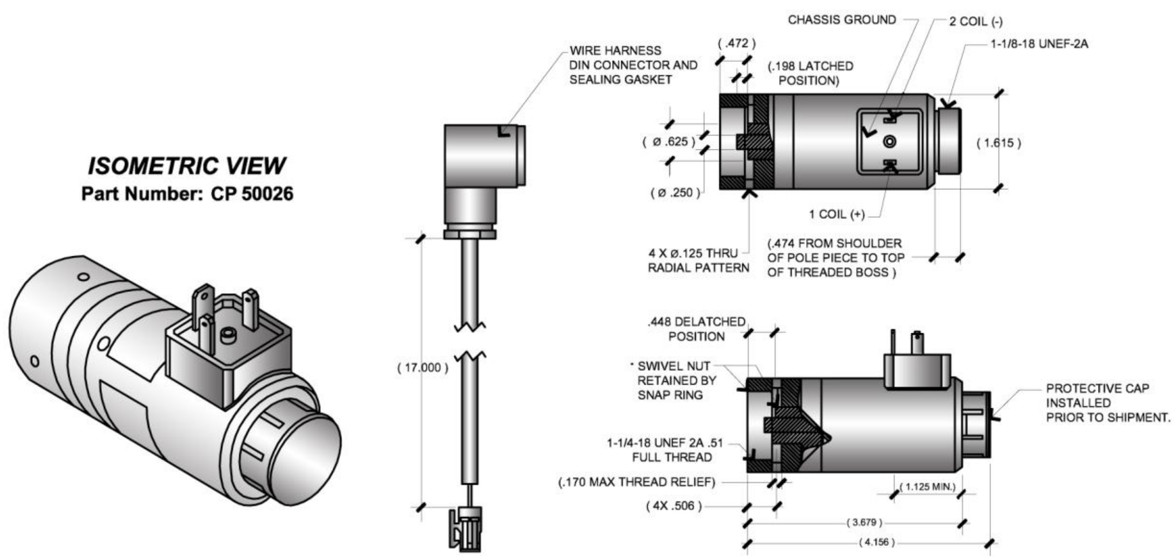
2.6.5 Latching Solenoid with Local Manual Control Head

2.6.5.1 Latching Solenoid

Latching Solenoid (Part Number: CP 50026) is used to open a Schrader valve on the top plug adaptor of the cylinder valve. The application provides a solution with a fast response and a high latching force to be used with the Context Plus Clean Agent Fire Suppression System. It is UL listed and tested in accordance to the UL508.

It was determined that a latching solenoid with an optional local manual control head is used as an alternative solution for the application when a pin actuation can be visible during system test with the latching solenoid removed from the top plug adapter. The actuator is held in the latched position without power until a signal from the agent release control panel cuts off the permanent magnet. When released, the latching solenoid opens the cylinder valve, allowing the extinguishing medium to discharge from the cylinder into the system. The fast response time allows the clean agent from the system to be released in the event of a fire. The latching solenoid is designed with an emergency release local manual control head to manually force the pin to depress the cylinder valve to release the extinguishing medium when needed.

Figure 23: Latching Solenoid

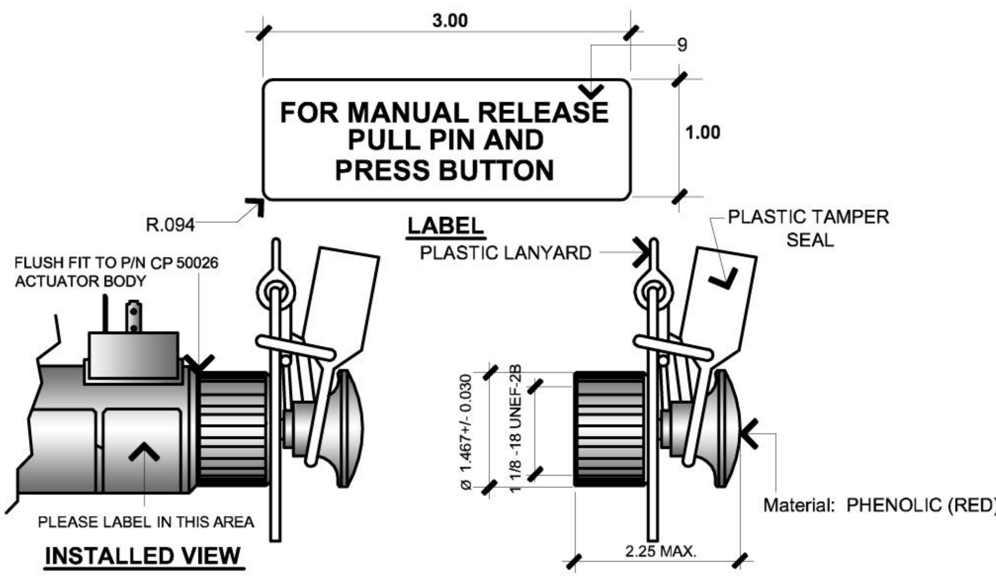


NOTE: In order to reset the system, the solenoid is to be manually returned to the latched position.

2.6.5.2 Local Manual Control Head

The Local Manual Control Head (Part Number: CP 61033-2) features a local lever driven push rod that depresses a Schrader check valve thru the latching solenoid when fitted onto the top of the solenoid, thereby venting the pressure from the top of the piston in the cylinder valve, allowing the piston to slide upward and commence cylinder discharge. The Local Manual Control Head can be mounted directly to a top plug adapter, which is the top piece of the cylinder valve.

Figure 24: Latching Solenoid with Local Manual Control Head



2.7 Agent Distribution Devices

2.7.1 Pipe, Pipe Fittings, and Pipe Supports

Pipe, pipe fittings, and pipe supports shall be in accordance to the latest edition of NFPA 2001 available from the National Fire Protection Association, Batterymarch Park, Quincy, MA-02269. Also, see the ANSI B 31.1, Power Piping Code.

2.7.1.1 Pipe Requirements

Pipe shall be a minimum of Schedule 40 steel pipe. Black or galvanized steel pipe shall follow the ASTM A-53, the ASTM A-106, or the ANSI B36.10.

NOTE:

1. **Cast-iron pipe and steel pipe conforming to the ASTM A-120, or non-metallic pipe shall NOT be used.**
2. **All piping must be thoroughly reamed to remove burrs and swabbed with a degreasing solvent to remove all traces of cutting oils and chips.**

2.7.1.2 *Pipe Fittings*

Pipe joints shall be Class 300 lb malleable iron only (ASTM A-197) and have a minimum working pressure of 620 psi (43 bars). The temperature ratings of the fittings must not be exceeded. Teflon tape must be applied on male threads only for screwed fittings (excluding the first two threads closest to the end of the pipe). All threaded joints must be in accordance to the ANSI B-20.1. Class 300 lb ductile iron or higher (ASTM A-395) or steel (ASTM A-234) is acceptable. The method of joining all pipes must be in accordance to the latest requirements listed in the NFPA 2001. Acceptable fittings include screwed, flanged, welded, and Victaulic.

All reductions in pipe size must be made by using concentric reducer fittings after the tee. Reducing bushings are not acceptable. All tees shall exit in the horizontal plane. See Tee Orientation in Figure 69 for details.

NOTE: Machined groove or roll grooved Victaulic fittings are to be used.

2.7.1.3 *Pipe Supports*

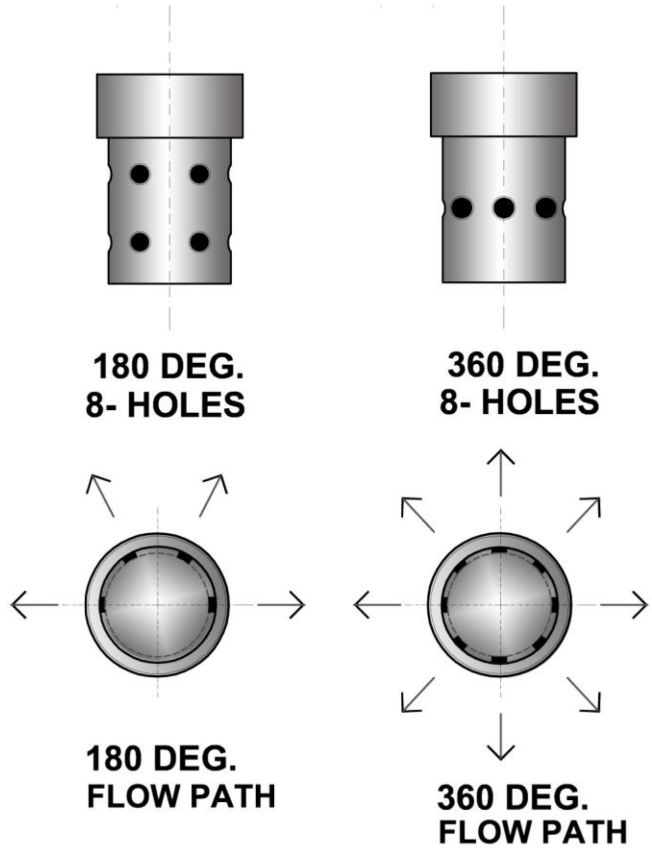
Pipe supports must be installed with allowance for expansion and contraction. They must be rated to support the dead weight of the pipes and the thrust forces of the HFC-227ea discharge. The piping for fire-extinguishing system shall be installed in accordance to proper commercial practices and securely supported by the UL Listed hangers. Refer to the ANSI B-31.1 Codes for bracing requirements.

2.7.2 Nozzles

Discharge nozzles are made of aluminum with female pipe threads. Nozzles are available in 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" sizes. These nozzles are available in two configurations, 180° sidewall and 360° central discharge patterns. Eight ports are used on both types of nozzles (Figure 22). All nozzles are rated for a minimum height of 1 ft and a maximum hazard height of 16 ft. If hazards exceed 16 ft in height, a second tier of nozzles must be used. See Figure 72 for details.

Any combination of types of nozzles could be used in a single area. When multiple nozzles are employed, the coverage for each nozzle must not exceed its maximum length and area of coverage. See Figure 70 for details.

Figure 25: Discharge Nozzle Types



2.7.2.1 Nozzle Selection

180° Sidewall: Typically to be installed adjacent to the center of one wall of one enclosure. Its discharge path will be across the enclosure. At no time shall the area coverage be exceeded. The use of two 180˚ nozzles may be installed at the center of the enclosure. See Figure 70 for details.

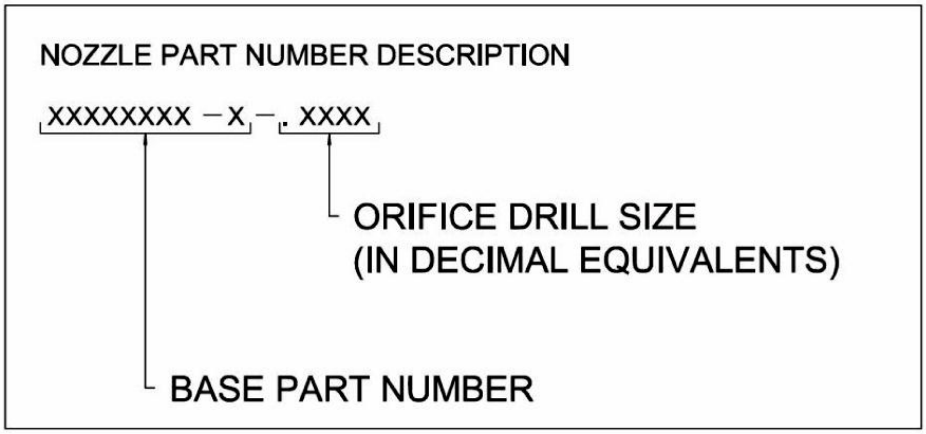
360° Central: Typically to be installed at the center of the enclosure. Its discharge path will be across the enclosure. At no time shall the area coverage be exceeded. See Figure 70 for details.

NOTE: For both types of nozzles the maximum hazard elevation is 16 ft when one level of nozzles is used. For hazards above 16 ft, the additional height is to be covered by the next level of nozzles. See Figure 72 for details.

2.7.2.2 *Nozzle Numbering System*

The part number of discharge nozzles consists of 3 letters followed by 10 digits (Figure 23). The CP prefix is standard for Context Plus Limited. The first 5 digits denote the NPT pipe size of the nozzle. The next digit denotes the discharge pattern ("2" represents the 180° sidewall nozzle while "3" represents the 360° central nozzle). The last 4 digits is the orifice drill size. A sample list of part numbers is given in Table 8.

Figure 26: CP Engineered Nozzle for Numbering System



EXAMPLE:
CP60705-2-.2610
3/4 PIPE THREADS, 180 DEG TYPE NOZZLE
DRILLED TO 0.2610 SIZE ORIFICE.

Table 9: A Sample List of Part Numbers of Discharge Nozzles

Part Number	NPT Pipe Size	Discharge Pattern	Drill Size Range
CP60704-2-.XXXX	½"	180° sidewall	0.0781 to 0.1960
CP60704-3-.XXXX	½"	360° central	0.0781 to 0.1960
CP60705-2-.XXXX	¾"	180° sidewall	0.1360 to 0.2610
CP60705-3-.XXXX	¾"	360° central	0.1360 to 0.2610
CP60706-2-.XXXX	1"	180° sidewall	0.1660 to 0.3320
CP60706-3-.XXXX	1"	360° central	0.1660 to 0.3320
CP60707-2-.XXXX	1 ¼"	180° sidewall	0.2187 to 0.4375
CP60707-3-.XXXX	1 ¼"	360° central	0.2187 to 0.4375
CP60708-2-.XXXX	1 ½"	180° sidewall	0.2570 to 0.5000
CP60708-3-.XXXX	1 ½"	360° central	0.2570 to 0.5000
CP60709-2-.XXXX	2"	180° sidewall	0.3281 to 0.6563
CP60709-3-.XXXX	2"	360° central	0.3281 to 0.6563

Note: ".XXXX"represents the orifice drill size.

Table 10: Part Numbers of the 180° Sidewall Nozzles

CP 60704-2
180° Sidewall Type
1/2 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.0781	0.03832	SF 60704-2-.0781
0.0785	0.03872	SF 60704-2-.0785
0.0810	0.04122	SF 60704-2-.0810
0.0820	0.04225	SF 60704-2-.0820
0.0860	0.04647	SF 60704-2-.0860
0.0890	0.04800	SF 60704-2-.0890
0.0935	0.05493	SF 60704-2-.0935
0.0937	0.05516	SF 60704-2-.0937
0.0960	0.05791	SF 60704-2-.0960
0.0980	0.06034	SF 60704-2-.0980
0.0998	0.06258	SF 60704-2-.0998
0.1015	0.06473	SF 60704-2-.1015
0.1040	0.06796	SF 60704-2-.1040
0.1065	0.07127	SF 60704-2-.1065
0.1094	0.07520	SF 60704-2-.1094
0.1100	0.07603	SF 60704-2-.1100
0.1110	0.07742	SF 60704-2-.1110
0.1130	0.08023	SF 60704-2-.1130
0.1160	0.08455	SF 60704-2-.1160
0.1200	0.09048	SF 60704-2-.1200
0.1250	0.09817	SF 60704-2-.1250
0.1285	0.10375	SF 60704-2-.1285
0.1360	0.11621	SF 60704-2-.1360
0.1406	0.12421	SF 60704-2-.1406
0.1440	0.13029	SF 60704-2-.1440
0.1470	0.13577	SF 60704-2-.1470
0.1495	0.14043	SF 60704-2-.1495
0.1520	0.14517	SF 60704-2-.1520
0.1540	0.14901	SF 60704-2-.1540
0.1562	0.15330	SF 60704-2-.1562
0.1570	0.15487	SF 60704-2-.1570
0.1590	0.15885	SF 60704-2-.1590
0.1610	0.16287	SF 60704-2-.1610
0.1660	0.17314	SF 60704-2-.1660
0.1695	0.18052	SF 60704-2-.1695
0.1719	0.18567	SF 60704-2-.1719
0.1730	0.18805	SF 60704-2-.1730
0.1770	0.19685	SF 60704-2-.1770
0.1800	0.20358	SF 60704-2-.1800
0.1820	0.20812	SF 60704-2-.1820
0.1850	0.21504	SF 60704-2-.1850
0.1875	0.22089	SF 60704-2-.1875
0.1890	0.22444	SF 60704-2-.1890
0.1910	0.22922	SF 60704-2-.1910
0.1935	0.23526	SF 60704-2-.1935
0.1960	0.24137	SF 60704-2-.1960

CP 60705-2
180° Sidewall Type
3/4 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.1360	0.11621	SF 60705-2-.1360
0.1406	0.12421	SF 60705-2-.1406
0.1440	0.13029	SF 60705-2-.1440
0.1470	0.13577	SF 60705-2-.1470
0.1495	0.14043	SF 60705-2-.1495
0.1520	0.14517	SF 60705-2-.1520
0.1540	0.14901	SF 60705-2-.1540
0.1562	0.15330	SF 60705-2-.1562
0.1570	0.15487	SF 60705-2-.1570
0.1590	0.15885	SF 60705-2-.1590
0.1610	0.16287	SF 60705-2-.1610
0.1660	0.17314	SF 60705-2-.1660
0.1695	0.18052	SF 60705-2-.1695
0.1719	0.18567	SF 60705-2-.1719
0.1730	0.18805	SF 60705-2-.1730
0.1770	0.19685	SF 60705-2-.1770
0.1800	0.20358	SF 60705-2-.1800
0.1820	0.20812	SF 60705-2-.1820
0.1850	0.21504	SF 60705-2-.1850
0.1875	0.22089	SF 60705-2-.1875
0.1890	0.22444	SF 60705-2-.1890
0.1910	0.22922	SF 60705-2-.1910
0.1935	0.23526	SF 60705-2-.1935
0.1960	0.24137	SF 60705-2-.1960
0.1990	0.24882	SF 60705-2-.1990
0.2010	0.25385	SF 60705-2-.2010
0.2031	0.25918	SF 60705-2-.2031
0.2040	0.26140	SF 60705-2-.2040
0.2051	0.26430	SF 60705-2-.2050
0.2090	0.27446	SF 60705-2-.2090
0.2130	0.28506	SF 60705-2-.2130
0.2187	0.30052	SF 60705-2-.2187
0.2210	0.30688	SF 60705-2-.2210
0.2280	0.32662	SF 60705-2-.2280
0.2340	0.34404	SF 60705-2-.2340
0.2344	0.34522	SF 60705-2-.2344
0.2380	0.35590	SF 60705-2-.2380
0.2420	0.36797	SF 60705-2-.2420
0.2460	0.38023	SF 60705-2-.2460
0.2500	0.39270	SF 60705-2-.2500
0.2570	0.41500	SF 60705-2-.2570
0.2610	0.42802	SF 60705-2-.2610

CP 60706-2
180° Sidewall Type
1 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.1660	0.17314	SF 60706-2-.1660
0.1695	0.18052	SF 60706-2-.1695
0.1719	0.18567	SF 60706-2-.1719
0.1730	0.18805	SF 60706-2-.1730
0.1770	0.19685	SF 60706-2-.1770
0.1800	0.20358	SF 60706-2-.1800
0.1820	0.20812	SF 60706-2-.1820
0.1850	0.21504	SF 60706-2-.1850
0.1875	0.22089	SF 60706-2-.1875
0.1890	0.22444	SF 60706-2-.1890
0.1910	0.22922	SF 60706-2-.1910
0.1935	0.23526	SF 60706-2-.1935
0.1960	0.24137	SF 60706-2-.1960
0.1990	0.24882	SF 60706-2-.1990
0.2010	0.25385	SF 60706-2-.2010
0.2031	0.25918	SF 60706-2-.2031
0.2040	0.26148	SF 60706-2-.2040
0.2055	0.26534	SF 60706-2-.2055
0.2090	0.27446	SF 60706-2-.2090
0.2130	0.28506	SF 60706-2-.2130
0.2187	0.30052	SF 60706-2-.2187
0.2210	0.30688	SF 60706-2-.2210
0.2280	0.32662	SF 60706-2-.2280
0.2340	0.34404	SF 60706-2-.2340
0.2344	0.34522	SF 60706-2-.2344
0.2380	0.35590	SF 60706-2-.2380
0.2420	0.36797	SF 60706-2-.2420
0.2460	0.38023	SF 60706-2-.2460
0.2500	0.39270	SF 60706-2-.2500
0.2570	0.41500	SF 60706-2-.2570
0.2610	0.42802	SF 60706-2-.2610
0.2656	0.44324	SF 60706-2-.2656
0.2660	0.44457	SF 60706-2-.2660
0.2720	0.46485	SF 60706-2-.2720
0.2770	0.48210	SF 60706-2-.2770
0.2810	0.49613	SF 60706-2-.2810
0.2812	0.49683	SF 60706-2-.2812
0.2900	0.52842	SF 60706-2-.2900
0.2950	0.54679	SF 60706-2-.2950
0.2969	0.55386	SF 60706-2-.2969
0.3020	0.57305	SF 60706-2-.3020
0.3125	0.61359	SF 60706-2-.3125
0.3160	0.62741	SF 60706-2-.3160
0.3230	0.65552	SF 60706-2-.3230
0.3281	0.67638	SF 60706-2-.3281
0.3320	0.69256	SF 60706-2-.3320

CP 60707-2
180° Sidewall Type
1 1/4 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.2187	0.30052	SF 60707-2-.2187
0.2210	0.30688	SF 60707-2-.2210
0.2280	0.32662	SF 60707-2-.2280
0.2340	0.34404	SF 60707-2-.2340
0.2344	0.34522	SF 60707-2-.2344
0.2380	0.35590	SF 60707-2-.2380
0.2420	0.36797	SF 60707-2-.2420
0.2460	0.38023	SF 60707-2-.2460
0.2500	0.39270	SF 60707-2-.2500
0.2570	0.41500	SF 60707-2-.2570
0.2610	0.42802	SF 60707-2-.2610
0.2656	0.44324	SF 60707-2-.2656
0.2660	0.44457	SF 60707-2-.2660
0.2720	0.46485	SF 60707-2-.2720
0.2770	0.48210	SF 60707-2-.2770
0.2810	0.49613	SF 60707-2-.2810
0.2812	0.49683	SF 60707-2-.2812
0.2900	0.52842	SF 60707-2-.2900
0.2950	0.54679	SF 60707-2-.2950
0.2969	0.55386	SF 60707-2-.2969
0.3020	0.57305	SF 60707-2-.3020
0.3125	0.61359	SF 60707-2-.3125
0.3160	0.62741	SF 60707-2-.3160
0.3230	0.65552	SF 60707-2-.3230
0.3281	0.67638	SF 60707-2-.3281
0.3320	0.69256	SF 60707-2-.3320
0.3390	0.72207	SF 60707-2-.3390
0.3437	0.74223	SF 60707-2-.3437
0.3480	0.76092	SF 60707-2-.3480
0.3580	0.80528	SF 60707-2-.3580
0.3594	0.81159	SF 60707-2-.3594
0.3680	0.85089	SF 60707-2-.3680
0.3750	0.88357	SF 60707-2-.3750
0.3770	0.89302	SF 60707-2-.3770
0.3860	0.93617	SF 60707-2-.3860
0.3906	0.95861	SF 60707-2-.3906
0.3970	0.99029	SF 60707-2-.3970
0.4040	1.02552	SF 60707-2-.4040
0.4062	1.03671	SF 60707-2-.4062
0.4130	1.07172	SF 60707-2-.4130
0.4219	1.11840	SF 60707-2-.4219
0.4375	1.20264	SF 60707-2-.4375

CP 60708-2
180° Sidewall Type
1 1/2 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.2570	0.41500	SF 60708-2-.2570
0.2610	0.42802	SF 60708-2-.2610
0.2656	0.44324	SF 60708-2-.2656
0.2660	0.44457	SF 60708-2-.2660
0.2720	0.46485	SF 60708-2-.2720
0.2770	0.48210	SF 60708-2-.2770
0.2810	0.49613	SF 60708-2-.2810
0.2812	0.49683	SF 60708-2-.2812
0.2900	0.52842	SF 60708-2-.2900
0.2950	0.54679	SF 60708-2-.2950
0.2969	0.55386	SF 60708-2-.2969
0.3020	0.57305	SF 60708-2-.3020
0.3125	0.61359	SF 60708-2-.3125
0.3160	0.62741	SF 60708-2-.3160
0.3230	0.65552	SF 60708-2-.3230
0.3281	0.67638	SF 60708-2-.3281
0.3320	0.69256	SF 60708-2-.3320
0.3390	0.72207	SF 60708-2-.3390
0.3437	0.74223	SF 60708-2-.3437
0.3480	0.76092	SF 60708-2-.3480
0.3580	0.80528	SF 60708-2-.3580
0.3594	0.81159	SF 60708-2-.3594
0.3680	0.85089	SF 60708-2-.3680
0.3750	0.88357	SF 60708-2-.3750
0.3770	0.89302	SF 60708-2-.3770
0.3860	0.93617	SF 60708-2-.3860
0.3906	0.95861	SF 60708-2-.3906
0.3970	0.99029	SF 60708-2-.3970
0.4040	1.02552	SF 60708-2-.4040
0.4062	1.03671	SF 60708-2-.4062
0.4130	1.07172	SF 60708-2-.4130
0.4219	1.11840	SF 60708-2-.4219
0.4375	1.20264	SF 60708-2-.4375
0.4531	1.28993	SF 60708-2-.4531
0.4688	1.38088	SF 60708-2-.4688
0.4844	1.47431	SF 60708-2-.4844
0.5000	1.57080	SF 60708-2-.5000

CP 60709-2
180° Sidewall Type
2 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.3281	0.67638	SF 60709-2-.3281
0.3320	0.69256	SF 60709-2-.3320
0.3390	0.72207	SF 60709-2-.3390
0.3437	0.74223	SF 60709-2-.3437
0.3480	0.76092	SF 60709-2-.3480
0.3580	0.80528	SF 60709-2-.3580
0.3594	0.81159	SF 60709-2-.3594
0.3680	0.85089	SF 60709-2-.3680
0.3750	0.88357	SF 60709-2-.3750
0.3770	0.89302	SF 60709-2-.3770
0.3860	0.93617	SF 60709-2-.3860
0.3906	0.95861	SF 60709-2-.3906
0.3970	0.99029	SF 60709-2-.3970
0.4040	1.02552	SF 60709-2-.4040
0.4062	1.03671	SF 60709-2-.4062
0.4130	1.07172	SF 60709-2-.4130
0.4219	1.11840	SF 60709-2-.4219
0.4375	1.20264	SF 60709-2-.4375
0.4531	1.28993	SF 60709-2-.4531
0.4688	1.38088	SF 60709-2-.4688
0.4844	1.47431	SF 60709-2-.4844
0.5000	1.57080	SF 60709-2-.5000
0.5156	1.67034	SF 60709-2-.5156
0.5313	1.77361	SF 60709-2-.5313
0.5469	1.87930	SF 60709-2-.5469
0.5625	1.98804	SF 60709-2-.5625
0.5781	2.09984	SF 60709-2-.5781
0.5938	2.21544	SF 60709-2-.5938
0.6094	2.33337	SF 60709-2-.6094
0.6250	2.45437	SF 60709-2-.6250
0.6406	2.57842	SF 60709-2-.6406
0.6563	2.70635	SF 60709-2-.6563

Table 11: Part Numbers of the 360° Central Nozzles

CP 60704 - 3
360° Central Type
1/2 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.0781	0.03832	SF 60704-3-.0781
0.0785	0.03872	SF 60704-3-.0785
0.0810	0.04122	SF 60704-3-.0810
0.0820	0.04225	SF 60704-3-.0820
0.0860	0.04647	SF 60704-3-.0860
0.0874	0.04800	SF 60704-3-.0890
0.0935	0.05493	SF 60704-3-.0935
0.0937	0.05516	SF 60704-3-.0937
0.0960	0.05791	SF 60704-3-.0960
0.0980	0.06034	SF 60704-3-.0980
0.0998	0.06258	SF 60704-3-.0998
0.1015	0.06473	SF 60704-3-.1015
0.1040	0.06796	SF 60704-3-.1040
0.1065	0.07127	SF 60704-3-.1065
0.1094	0.07520	SF 60704-3-.1094
0.1100	0.07603	SF 60704-3-.1100
0.1110	0.07742	SF 60704-3-.1110
0.1130	0.08023	SF 60704-3-.1130
0.1160	0.08455	SF 60704-3-.1160
0.1200	0.09048	SF 60704-3-.1200
0.1250	0.09817	SF 60704-3-.1250
0.1285	0.10375	SF 60704-3-.1285
0.1360	0.11621	SF 60704-3-.1360
0.1406	0.12421	SF 60704-3-.1406
0.1440	0.13029	SF 60704-3-.1440
0.1470	0.13577	SF 60704-3-.1470
0.1495	0.14043	SF 60704-3-.1495
0.1520	0.14517	SF 60704-3-.1520
0.1540	0.14901	SF 60704-3-.1540
0.1562	0.15330	SF 60704-3-.1562
0.1570	0.15487	SF 60704-3-.1570
0.1590	0.15885	SF 60704-3-.1590
0.1610	0.16287	SF 60704-3-.1610
0.1660	0.17314	SF 60704-3-.1660
0.1695	0.18052	SF 60704-3-.1695
0.1719	0.18567	SF 60704-3-.1719
0.1730	0.18805	SF 60704-3-.1730
0.1770	0.19685	SF 60704-3-.1770
0.1800	0.20358	SF 60704-3-.1800
0.1820	0.20812	SF 60704-3-.1820
0.1850	0.21504	SF 60704-3-.1850
0.1875	0.22089	SF 60704-3-.1875
0.1890	0.22444	SF 60704-3-.1890
0.1910	0.22922	SF 60704-3-.1910
0.1935	0.23526	SF 60704-3-.1935
0.1960	0.24137	SF 60704-3-.1960

CP 60705 - 3
360° Central Type
3/4 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.1360	0.11621	SF 60705-3-.1360
0.1406	0.12421	SF 60705-3-.1406
0.1440	0.13029	SF 60705-3-.1440
0.1470	0.13577	SF 60705-3-.1470
0.1495	0.14043	SF 60705-3-.1495
0.1520	0.14517	SF 60705-3-.1520
0.1540	0.14901	SF 60705-3-.1540
0.1562	0.15330	SF 60705-3-.1562
0.1570	0.15487	SF 60705-3-.1570
0.1590	0.15885	SF 60705-3-.1590
0.1610	0.16287	SF 60705-3-.1610
0.1660	0.17314	SF 60705-3-.1660
0.1695	0.18052	SF 60705-3-.1695
0.1719	0.18567	SF 60705-3-.1719
0.1730	0.18805	SF 60705-3-.1730
0.1770	0.19685	SF 60705-3-.1770
0.1800	0.20358	SF 60705-3-.1800
0.1820	0.20812	SF 60705-3-.1820
0.1850	0.21504	SF 60705-3-.1850
0.1875	0.22089	SF 60705-3-.1875
0.1890	0.22444	SF 60705-3-.1890
0.1910	0.22922	SF 60705-3-.1910
0.1935	0.23526	SF 60705-3-.1935
0.1960	0.24137	SF 60705-3-.1960
0.1990	0.24882	SF 60705-3-.1990
0.2010	0.25385	SF 60705-3-.2010
0.2031	0.25918	SF 60705-3-.2031
0.2040	0.26140	SF 60705-3-.2040
0.2051	0.26430	SF 60705-3-.2050
0.2090	0.27446	SF 60705-3-.2090
0.2130	0.28506	SF 60705-3-.2130
0.2187	0.30052	SF 60705-3-.2187
0.2210	0.30688	SF 60705-3-.2210
0.2280	0.32662	SF 60705-3-.2280
0.2340	0.34404	SF 60705-3-.2340
0.2344	0.34522	SF 60705-3-.2344
0.2380	0.35590	SF 60705-3-.2380
0.2420	0.36797	SF 60705-3-.2420
0.2460	0.38023	SF 60705-3-.2460
0.2500	0.39270	SF 60705-3-.2500
0.2570	0.41500	SF 60705-3-.2570
0.2610	0.42802	SF 60705-3-.2610

CP 60706 - 3
360° Central Type
1 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.1660	0.17314	SF 60706-3-.1660
0.1695	0.18052	SF 60706-3-.1695
0.1719	0.18567	SF 60706-3-.1719
0.1730	0.18805	SF 60706-3-.1730
0.1770	0.19685	SF 60706-3-.1770
0.1800	0.20358	SF 60706-3-.1800
0.1820	0.20812	SF 60706-3-.1820
0.1850	0.21504	SF 60706-3-.1850
0.1875	0.22089	SF 60706-3-.1875
0.1890	0.22444	SF 60706-3-.1890
0.1910	0.22922	SF 60706-3-.1910
0.1935	0.23526	SF 60706-3-.1935
0.1960	0.24137	SF 60706-3-.1960
0.1990	0.24882	SF 60706-3-.1990
0.2010	0.25385	SF 60706-3-.2010
0.2031	0.25918	SF 60706-3-.2031
0.2040	0.26148	SF 60706-3-.2040
0.2055	0.26534	SF 60706-3-.2055
0.2090	0.27446	SF 60706-3-.2090
0.2130	0.28506	SF 60706-3-.2130
0.2187	0.30052	SF 60706-3-.2187
0.2210	0.30688	SF 60706-3-.2210
0.2280	0.32662	SF 60706-3-.2280
0.2340	0.34404	SF 60706-3-.2340
0.2340	0.34400	SF 60706-3-.2340
0.2380	0.35590	SF 60706-3-.2380
0.2420	0.36797	SF 60706-3-.2420
0.2460	0.38023	SF 60706-3-.2460
0.2500	0.39270	SF 60706-3-.2500
0.2570	0.41500	SF 60706-3-.2570
0.2610	0.42802	SF 60706-3-.2610
0.2656	0.44324	SF 60706-3-.2656
0.2660	0.44457	SF 60706-3-.2660
0.2720	0.46485	SF 60706-3-.2720
0.2770	0.48210	SF 60706-3-.2770
0.2810	0.49613	SF 60706-3-.2810
0.2812	0.49683	SF 60706-3-.2812
0.2900	0.52842	SF 60706-3-.2900
0.2950	0.54679	SF 60706-3-.2950
0.2969	0.55386	SF 60706-3-.2969
0.3020	0.57305	SF 60706-3-.3020
0.3125	0.61359	SF 60706-3-.3125
0.3160	0.62741	SF 60706-3-.3160
0.3230	0.65552	SF 60706-3-.3230
0.3281	0.67638	SF 60706-3-.3281
0.3320	0.69256	SF 60706-3-.3320

CP 60707 - 3
360° Central Type
1 1/4 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.2187	0.30052	SF 60707-3-.2187
0.2210	0.30688	SF 60707-3-.2210
0.2280	0.32662	SF 60707-3-.2280
0.2340	0.34404	SF 60707-3-.2340
0.2344	0.34522	SF 60707-3-.2344
0.2380	0.35590	SF 60707-3-.2380
0.2420	0.36797	SF 60707-3-.2420
0.2460	0.38023	SF 60707-3-.2460
0.2500	0.39270	SF 60707-3-.2500
0.2570	0.41500	SF 60707-3-.2570
0.2610	0.42802	SF 60707-3-.2610
0.2656	0.44324	SF 60707-3-.2656
0.2660	0.44457	SF 60707-3-.2660
0.2720	0.46485	SF 60707-3-.2720
0.2770	0.48210	SF 60707-3-.2770
0.2810	0.49613	SF 60707-3-.2810
0.2812	0.49683	SF 60707-3-.2812
0.2900	0.52842	SF 60707-3-.2900
0.2950	0.54679	SF 60707-3-.2950
0.2969	0.55386	SF 60707-3-.2969
0.3020	0.57305	SF 60707-3-.3020
0.3125	0.61359	SF 60707-3-.3125
0.3160	0.62741	SF 60707-3-.3160
0.3230	0.65552	SF 60707-3-.3230
0.3281	0.67638	SF 60707-3-.3281
0.3320	0.69256	SF 60707-3-.3320
0.3390	0.72207	SF 60707-3-.3390
0.3437	0.74223	SF 60707-3-.3437
0.3480	0.76092	SF 60707-3-.3480
0.3580	0.80528	SF 60707-3-.3580
0.3594	0.81159	SF 60707-3-.3594
0.3680	0.85089	SF 60707-3-.3680
0.3750	0.88357	SF 60707-3-.3750
0.3770	0.89302	SF 60707-3-.3770
0.3860	0.93617	SF 60707-3-.3860
0.3906	0.95861	SF 60707-3-.3906
0.3970	0.99029	SF 60707-3-.3970
0.4040	1.02552	SF 60707-3-.4040
0.4062	1.03671	SF 60707-3-.4062
0.4130	1.07172	SF 60707-3-.4130
0.4219	1.11840	SF 60707-3-.4219
0.4375	1.20264	SF 60707-3-.4375

CP 60708 - 3
360° Central Type
1 1/2 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.2570	0.41500	SF 60708-3-.2570
0.2610	0.42802	SF 60708-3-.2610
0.2656	0.44324	SF 60708-3-.2656
0.2660	0.44457	SF 60708-3-.2660
0.2720	0.46485	SF 60708-3-.2720
0.2770	0.48210	SF 60708-3-.2770
0.2810	0.49613	SF 60708-3-.2810
0.2812	0.49683	SF 60708-3-.2812
0.2900	0.52842	SF 60708-3-.2900
0.2950	0.54679	SF 60708-3-.2950
0.2969	0.55386	SF 60708-3-.2969
0.3020	0.57305	SF 60708-3-.3020
0.3125	0.61359	SF 60708-3-.3125
0.3160	0.62741	SF 60708-3-.3160
0.3230	0.65552	SF 60708-3-.3230
0.3281	0.67638	SF 60708-3-.3281
0.3320	0.69256	SF 60708-3-.3320
0.3390	0.72207	SF 60708-3-.3390
0.3437	0.74223	SF 60708-3-.3437
0.3480	0.76092	SF 60708-3-.3480
0.3580	0.80528	SF 60708-3-.3580
0.3594	0.81159	SF 60708-3-.3594
0.3680	0.85089	SF 60708-3-.3680
0.3750	0.88357	SF 60708-3-.3750
0.3770	0.89302	SF 60708-3-.3770
0.3860	0.93617	SF 60708-3-.3860
0.3906	0.95861	SF 60708-3-.3906
0.3970	0.99029	SF 60708-3-.3970
0.4040	1.02552	SF 60708-3-.4040
0.4062	1.03671	SF 60708-3-.4062
0.4130	1.07172	SF 60708-3-.4130
0.4219	1.11840	SF 60708-3-.4219
0.4375	1.20264	SF 60708-3-.4375
0.4531	1.28993	SF 60708-3-.4531
0.4688	1.38088	SF 60708-3-.4688
0.4844	1.47431	SF 60708-3-.4844
0.5000	1.57080	SF 60708-3-.5000

CP 60709 - 3
360° Central Type
2 Inch Type Nozzles

Drill Dia.	Total Orifice Area	Nozzle Part Number
0.3281	0.67638	SF 60709-3-.3281
0.3320	0.69256	SF 60709-3-.3320
0.3390	0.72207	SF 60709-3-.3390
0.3437	0.74223	SF 60709-3-.3437
0.3480	0.76092	SF 60709-3-.3480
0.3580	0.80528	SF 60709-3-.3580
0.3594	0.81159	SF 60709-3-.3594
0.3680	0.85089	SF 60709-3-.3680
0.3750	0.88357	SF 60709-3-.3750
0.3770	0.89302	SF 60709-3-.3770
0.3860	0.93617	SF 60709-3-.3860
0.3906	0.95861	SF 60709-3-.3906
0.3970	0.99029	SF 60709-3-.3970
0.4040	1.02552	SF 60709-3-.4040
0.4062	1.03671	SF 60709-3-.4062
0.4130	1.07172	SF 60709-3-.4130
0.4219	1.11840	SF 60709-3-.4219
0.4375	1.20264	SF 60709-3-.4375
0.4531	1.28993	SF 60709-3-.4531
0.4688	1.38088	SF 60709-3-.4688
0.4844	1.47431	SF 60709-3-.4844
0.5000	1.57080	SF 60709-3-.5000
0.5156	1.67034	SF 60709-3-.5156
0.5313	1.77361	SF 60709-3-.5313
0.5469	1.87930	SF 60709-3-.5469
0.5625	1.98804	SF 60709-3-.5625
0.5781	2.09984	SF 60709-3-.5781
0.5938	2.21544	SF 60709-3-.5938
0.6094	2.33337	SF 60709-3-.6094
0.6250	2.45437	SF 60709-3-.6250
0.6406	2.57842	SF 60709-3-.6406
0.6563	2.70635	SF 60709-3-.6563

2.7.3 Flexible Hoses

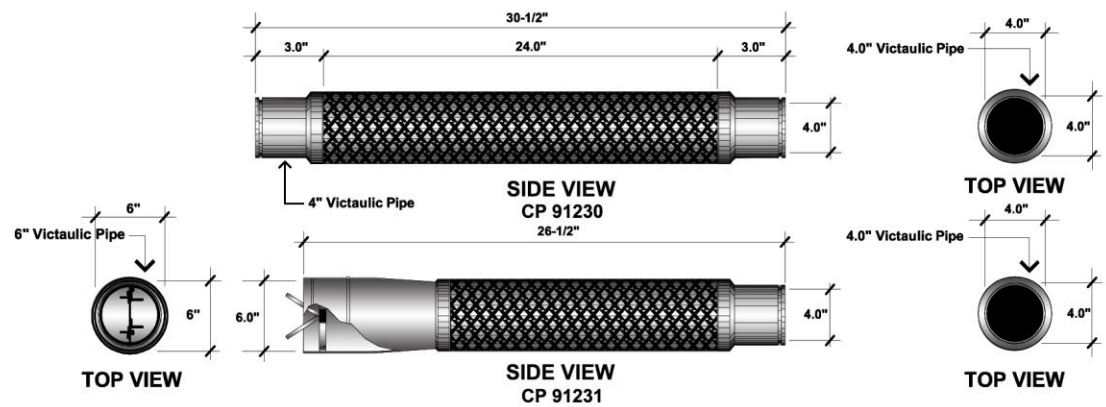
Flexible hoses (flex hoses) are used to connect the agent storage containers to the manifold in multiple cylinders arrangement. Flex hoses are 18" long and constructed of high pressure hydraulic rubber in the 1", and 1-1/2" sizes or stainless steel corrugated inner core with stainless steel braided in the 2-1/2" and 4" sizes. See Figure 24 for details. All sizes except for the 4" flex hose are fitted with male NPT threads on both ends. The 4" version has a grooved fitting on both ends.

The recommended assembly configuration is to install a union elbow to the discharge outlet of the cylinder valve. Then, install the flex hose between the union elbow and a check valve, with the check valve connected to the appropriate fitting in the manifold.

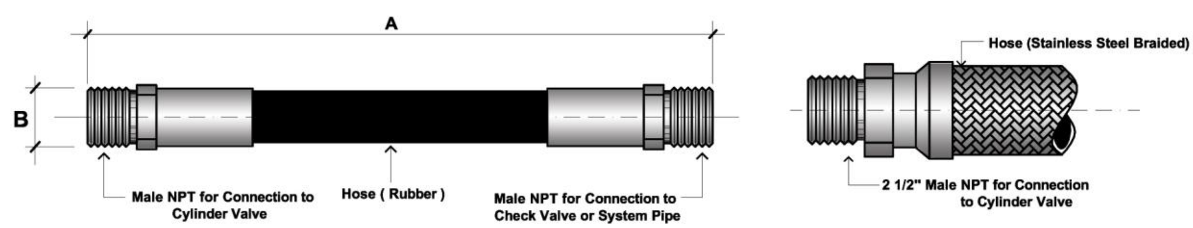
The 1200 lb cylinder can be provided with a 4" flex hose or a flex hose & check valve assembly for manifold. The 4" check valves without hoses are available upon request. The flex hose & check valve assembly is used when the multiple cylinders are connected to the manifold.

NOTE: The 1", 1-1/2", and 2-1/2" flex hoses are to be installed straight and going up into the check valve only. No bends of the flex hose are to be used at the installation. The 4" flex hose may be mounted horizontally or vertically.

Figure 27: Flexible Hoses



Part Number	Description	Length	Diameter	Material
CP 91230	Flex Hose	30 1/2 "	4.0"	Stainless Steel Braided
CP 91231	Flex Hose & Check Ass'y	26 1/2 "	4"x 6"	Stainless Steel Braided



PART NO.	A	B	MATERIAL
CP 60255	18"	1"	RUBBER

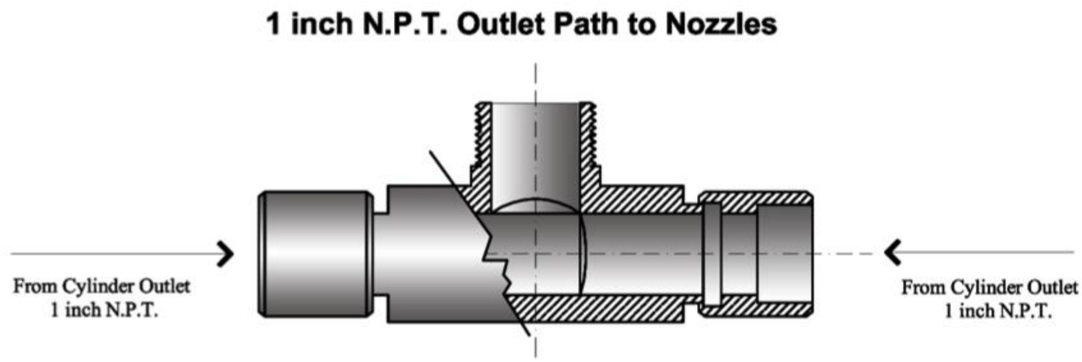
PART NO.	A	B	MATERIAL
CP 60256	18"	1 1/2"	RUBBER

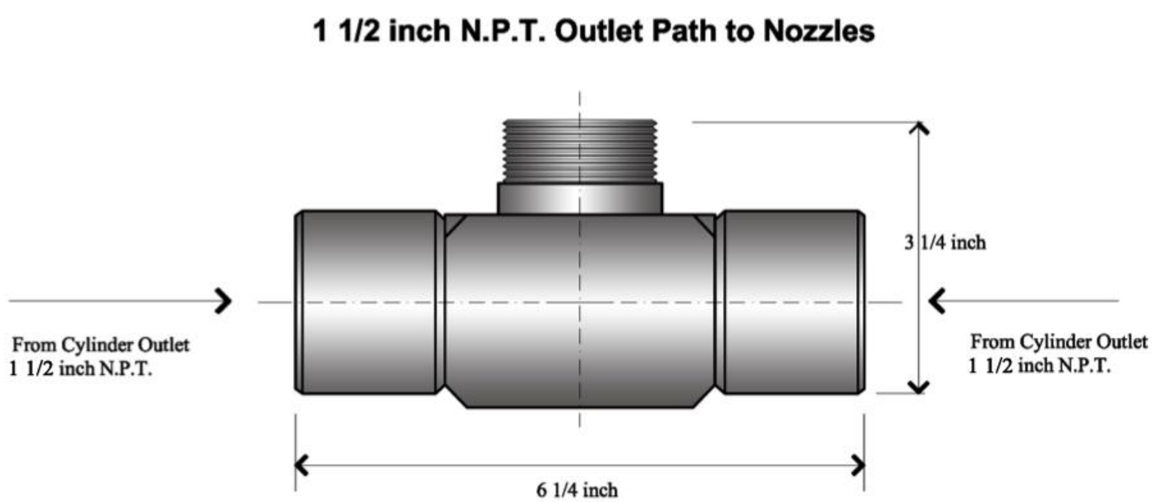
PART NO.	A	B	MATERIAL
CP 60257	18"	2 1/2"	Stainless Steel Braided

2.7.4 Shuttle Check Valves

The shuttle check valve is used to connect two cylinders to a common discharge pipe in a main-reserve configuration. The shuttle valve contains a shuttle check, which closes off the pipe to the empty cylinder (main) to allow the discharge from the reserve cylinder to flow through the discharge piping. The shuttle check valve is available in 1”size for the 35 lb and 70 lb cylinders and 1-1/2”size for the 150 lb, 250 lb, and 375 lb (fill up to 250 lb maximum) cylinders. See Figure 25 for details.

Figure 28: Shuttle Check Valves



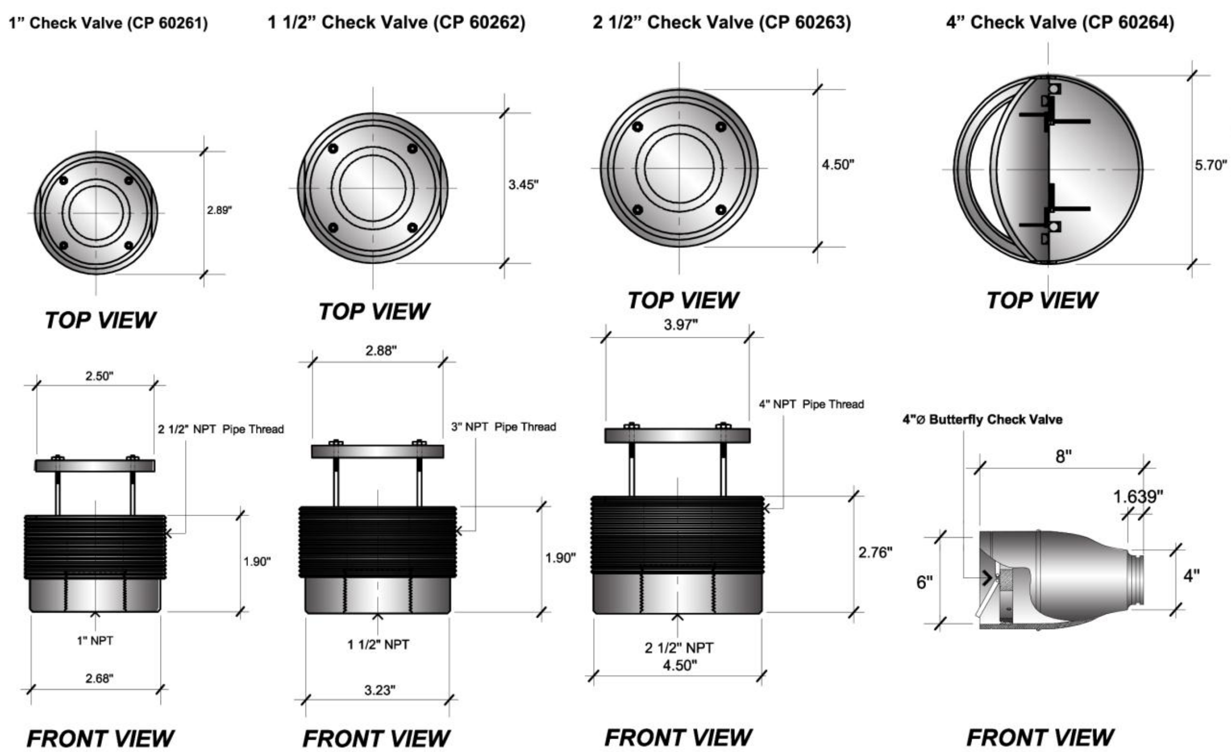


2.7.5 Manifold Check Valves

Manifold Check Valves are used when two or more agent storage cylinders are manifolded together with one common discharge piping configuration. Their purpose is to prevent the loss of agent in the event that any of the agent storage cylinders are not connected to the manifold at time of system discharge and to prevent back flow of agent into other cylinders attached to the manifold.

All components of the Manifold Check Valves are constructed from brass for durability and protection against corrosion. The metal to metal sealing area of the disc and seat is precision lapped, providing a very tight shut-off of both gas and liquid. The Manifold Check Valves must be installed in the vertical position only with check disc on top. Figure 26 shows the configuration and dimensional details of the Manifold Check Valves.

Figure 29: Manifold Check Valves



NOTE: The 1 inch, 1 ½ inch, and 2 ½ inch check valves are to be installed vertically only.

Table 12: Part Numbers and Sizes of Manifold Check Valves

Part Number	Description	Valve Size
CP 60261	Manifold Check Valve	1”
CP 60262	Manifold Check Valve	1 ½”
CP 60263	Manifold Check Valve	2 ½”
CP 60264	Manifold Check Valve	4”

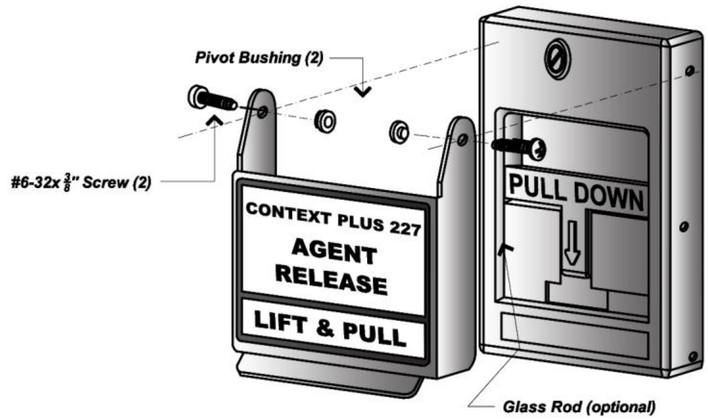
2.8 Accessories

2.8.1 Control Switches

2.8.1.1 Manual Control – Electrical Pull Station

The cylinder valve can be electrically actuated by means of a Manual Control - Electrical Pull Station wired to the U.L. Listed Control Panel for releasing device service. The releasing panel must be compatible with Context Plus Electric Solenoids. This configuration can be backed up with a Local Manual Control Head mounted on top of a Top Plug Adapter.

Figure 30: Manual Control – Electrical Pull Station



2.8.1.2 Main-Reserve Selector Switch

The “Main” to “Reserve” Switch (Part Number: CP 50195-1) is used with systems that incorporate main and reserve (bank-up) agent storage. The switch may utilize 1 or 2 Form “C” Contact Blocks, which will provide an electrical path to either the “Main” or “Reserve” agent release modules. Following a system discharge, reset any field devices. Once all devices are in a stand-by status, the Main-Reserve Switch may be moved to the “Reserve” position. The Control Panel may then be reset to a normal mode for uninterrupted Context Plus protection. The empty “Main” container can be removed for recharge. After the container in the “Main” system has been recharged, the switch may be returned to the “Main” position. The switch is mounted on a standard 4” electrical enclosure.

Figure 31: Main-Reserve Selector Switch

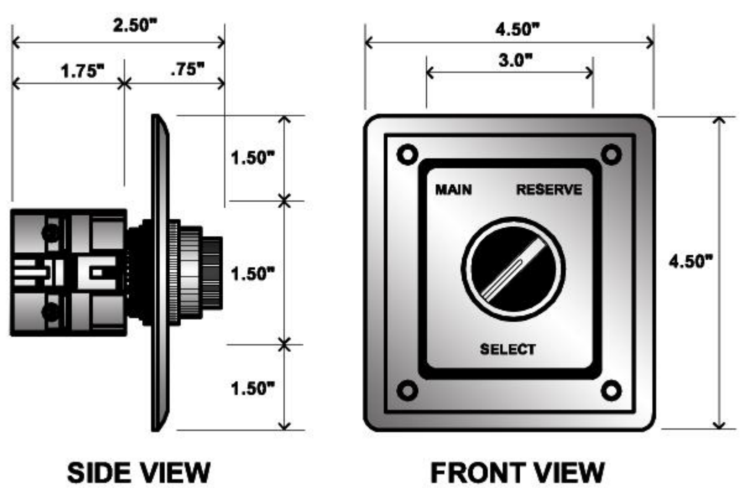
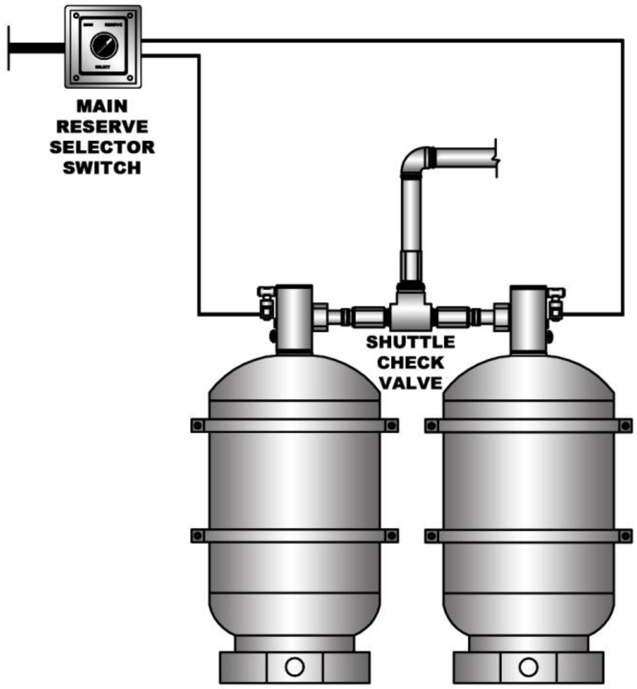


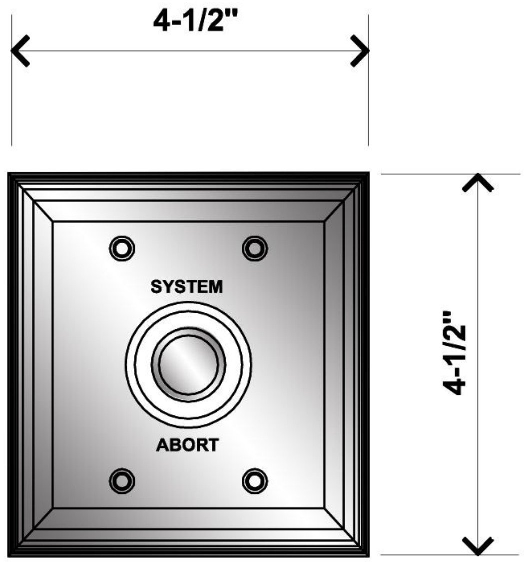
Figure 32: Use of Main-Reserve Selector Switch



2.8.1.3 Abort Switch

The Abort Switch (Part Number: CP 88105) is designed to be used in conjunction with other system equipment. It provides a temporary manual means, whereby the system actuation circuit may be interrupted when operated prior to the circuit actuation. The unit employs a momentary contact push button switch. While depressed, the switch causes the agent release circuit to be manually delayed. Upon release of the Abort Switch, the release circuit will follow the specific configuration of the U.L. Listed Control Panel. The Abort Switch is mounted on a standard double gang electrical enclosure.

Figure 33: Abort Switch



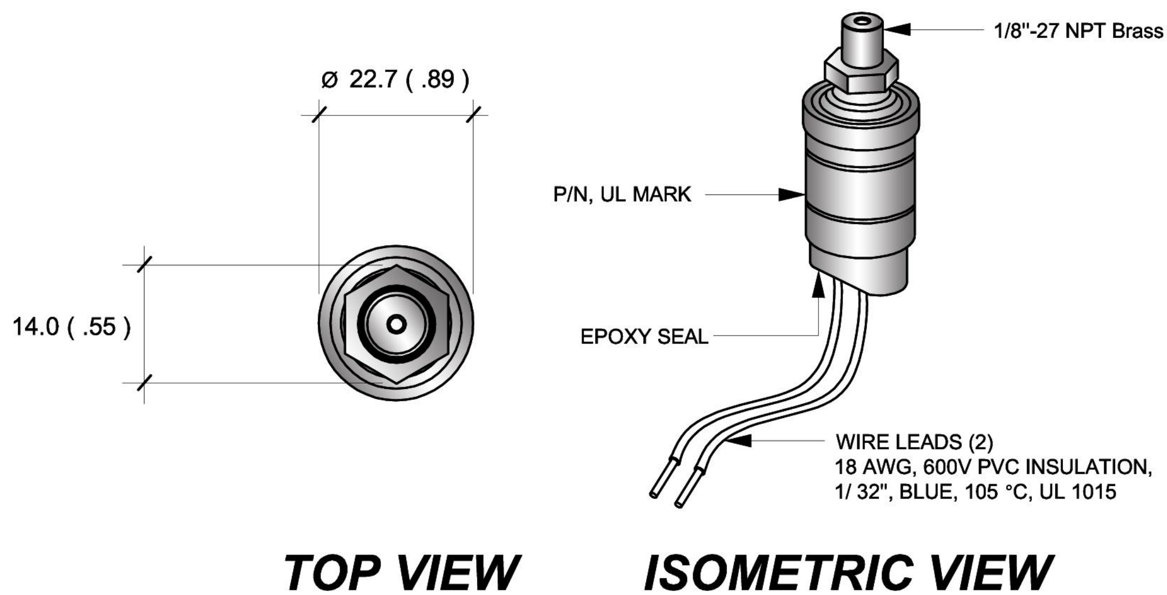
2.8.2 Initiating Devices

2.8.2.1 Pressure Supervisory Switch

The Pressure Supervisory Switch (Figure 31) is to monitor the pressure within the cylinder. It is attached to the port marked “P”. If the cylinder to which it is attached leaks, its pressure drops to 291 ± 10 psig (Release Pressure) or below, the switch contact will operate giving an indication on the Control Panel that the cylinder has lost pressure.

One version of the switch is normally closed (N.C.) (Part Number: CP 50138-1) and the second version is normally open (N.O.) (Part Number: CP 50138-2). The switch is referenced in the no pressure condition. When the cylinder is pressurized until the actuation pressure (360 ± 10 psig) is reached, the contact for the normally closed (N.C.) switch will shift from normally closed to normally open status and vice versa for the normally open (N.O.) switch. However, when the cylinder is de-pressurized until the release pressure is reached, the contact will shift back to its original status. When the switch is used on a standard supervisory input circuit, there will be no distinction between a wiring fault and a device actuation.

Figure 34: Pressure Supervisory Switch

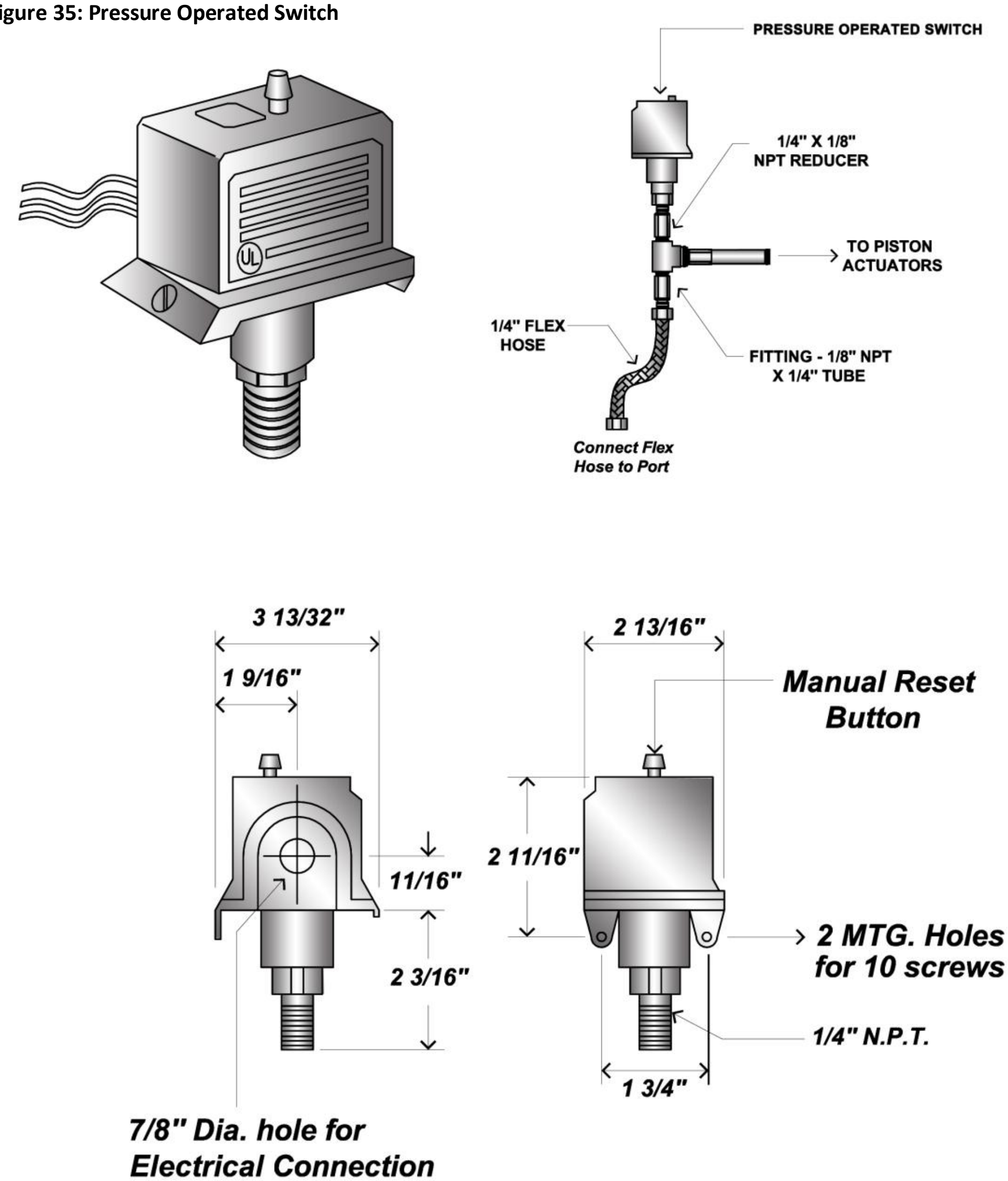


2.8.2.2 *Pressure Operated Switch*

The switch (Part Number: CP 50339) is provided to furnish additional electrical contacts for control purposes at time of discharge. See Figure 32 for details. The switch may be installed into the same pneumatic tubing for the Piston Actuators provided the maximum length for tubing outlined in Table 7 is not exceeded. The switch may also be connected to any point of the discharge piping between the cylinder and the nozzle. An external manual reset button is provided on the pressure switch. After the system is activated, the reset button must be depressed in order to return the device being controlled back to the pre-discharge state.

Engineering Specifications:
Electrical Rating: 15 Amps - 125/250 VAC;
Switch: SPDT snap action;
Contacts: One N.O. and One N.C.

Figure 35: Pressure Operated Switch



2.8.3 Liquid Level Indicator

The Context Plus Liquid Level Indicator is a simple, manually operated device, which provides a means to determine the Clean Agent liquid level in vertically mounted agent storage containers. Once the liquid level is determined, it can then be converted into pounds (kilograms) of Clean Agent present in the agent storage container.

A magnet equipped float moves with the liquid level along the unit stem. Level readout is obtained by simply removing the protective cap and pulling out a calibrated tape until magnetic interlock with the float is felt. With the tape in this position, the readout is obtained at the point where the tape emerges from the unit housing. With the graph (per cylinder size), the tape reading is converted to lbs. of Clean Agent in the cylinder. Accurate readings can be obtained over a 40 ^{o}F to 90 ^{o}F temperature range. Tolerance is ±2% of cylinder fill weight. The part numbers of Liquid Level Indicator are given in Table 12.

Figure 36: Liquid Level Measuring Instrument

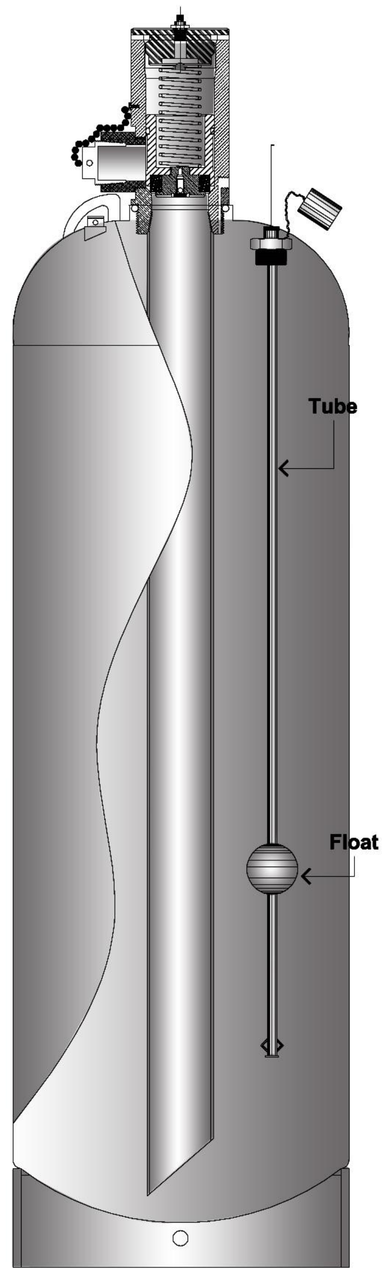
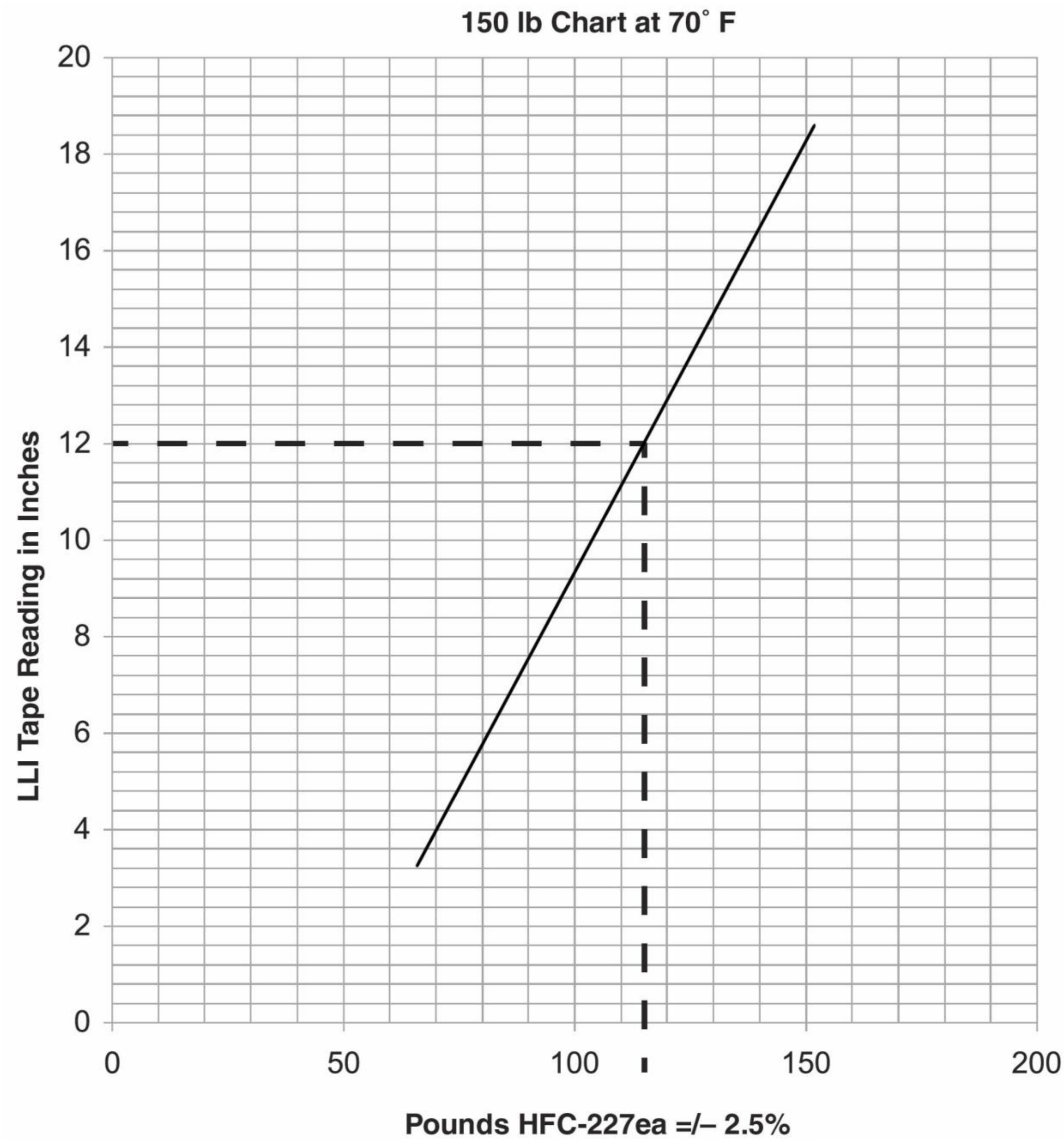


Table 13: Liquid Level Indicator

Part Number	Cylinder Size
CP 60020	150 lb – 250 lb
CP 60020-1	375 lb – 560 lb
CP 60020-2	1200 lb

Figure 37: LLI Tape Reading (in Inches) versus Weight of HFC-227ea (in Pounds) for 150 lb Cylinder



EXAMPLE:
DATA = 12 INCHES
TEMP. = 70°
AGENT IN CYLINDER = 116 LBS.

Figure 38: LLI Tape Reading (in Inches) versus Weight of HFC-227ea (in Pounds) for 250 lb Cylinder

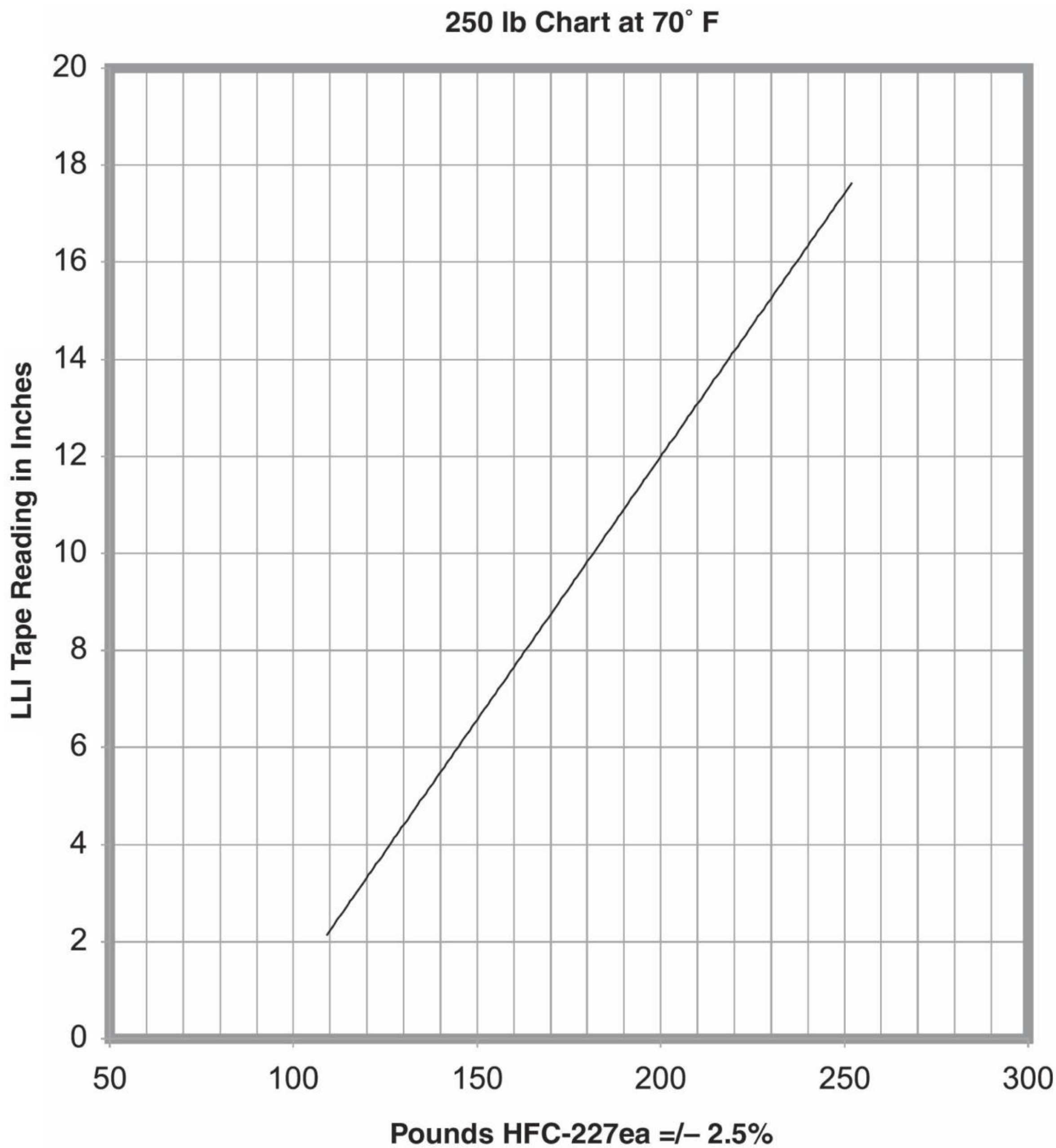


Figure 39: LLI Tape Reading (in Inches) versus Weight of HFC-227ea (in Pounds) for 375 lb Cylinder

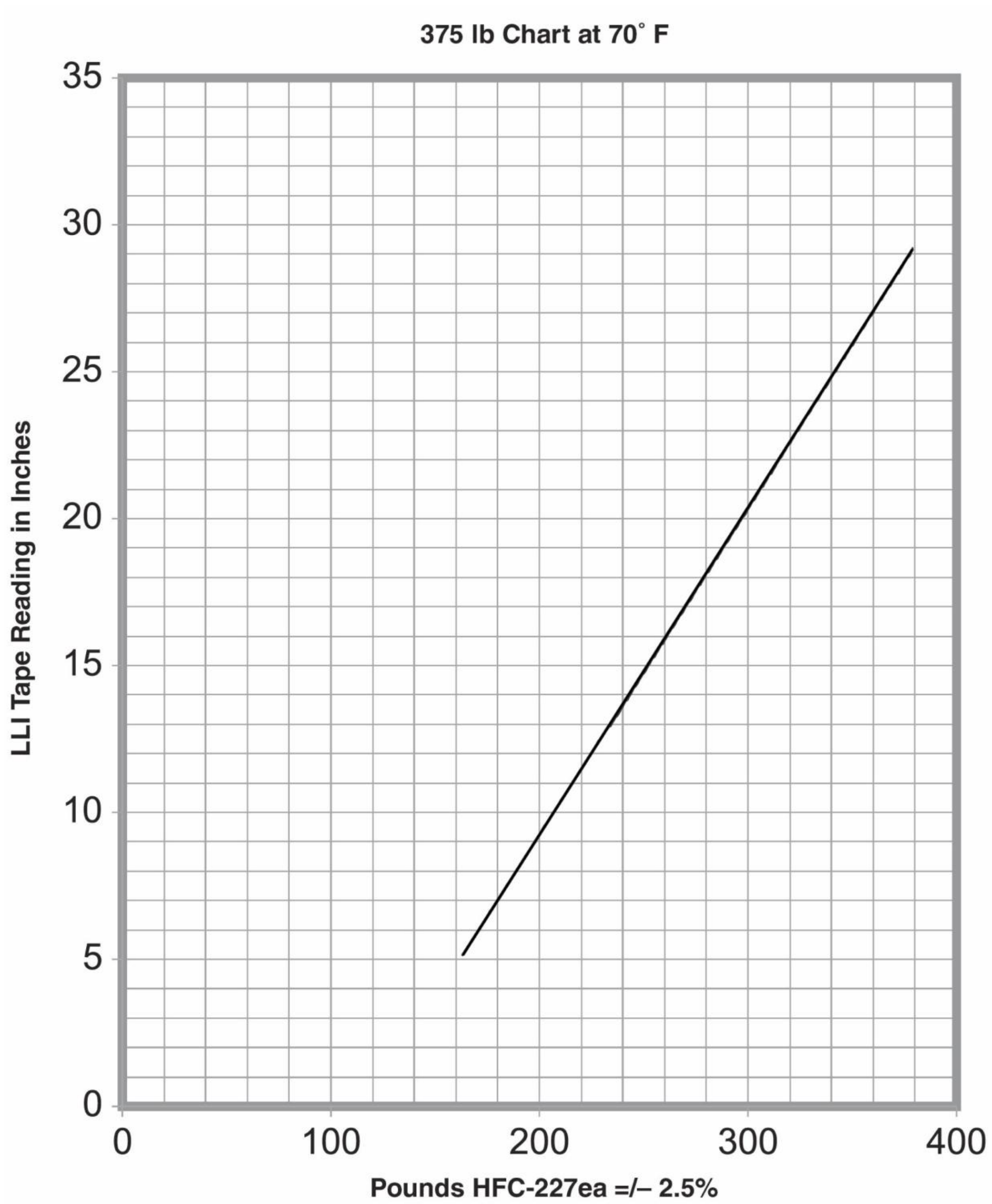


Figure 40: LLI Tape Reading (in Inches) versus Weight of HFC-227ea (in Pounds) for 560 lb Cylinder

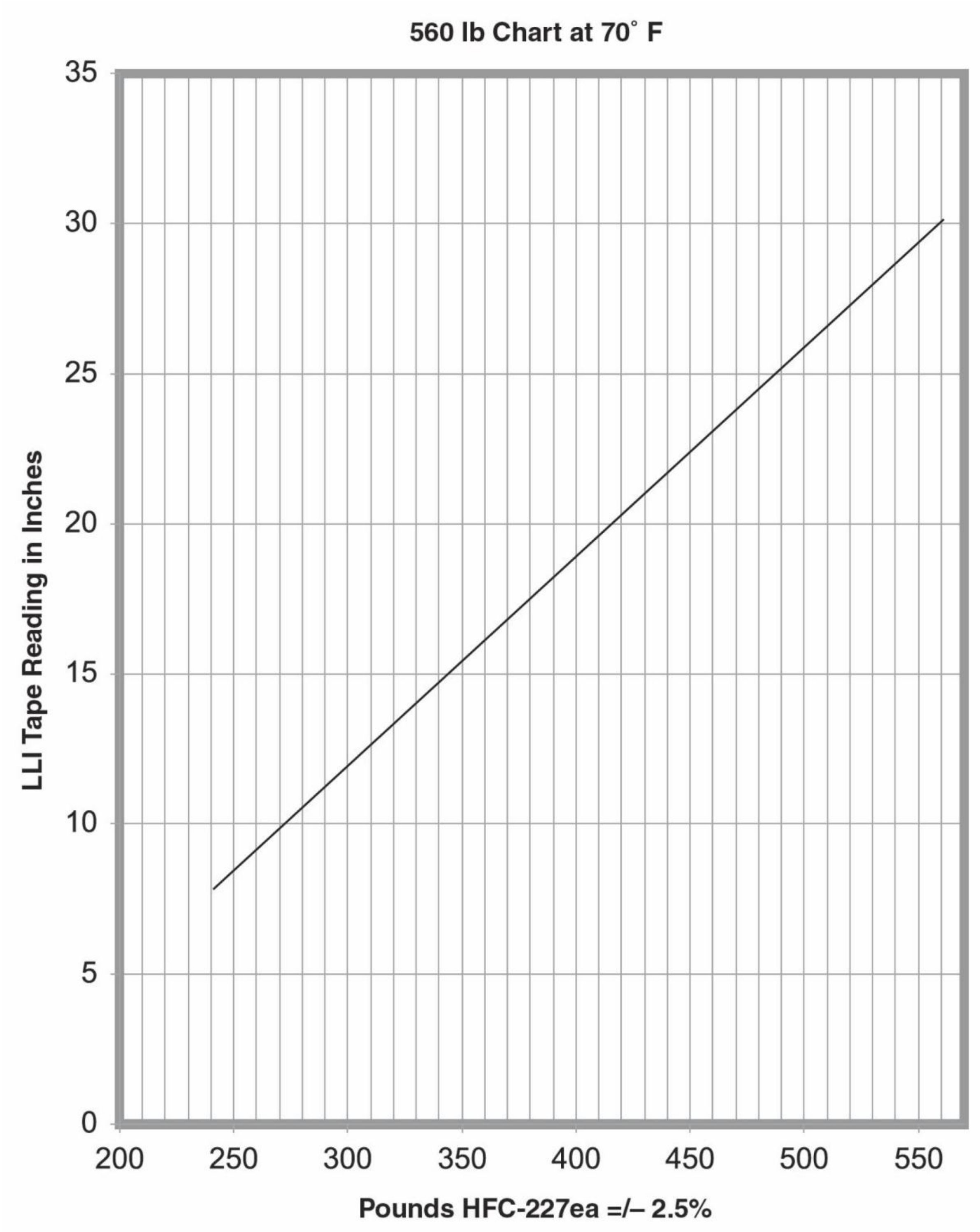


Figure 41: LLI Tape Reading (in Inches) versus Weight of HFC-227ea (in Pounds) for 1200 lb Cylinder

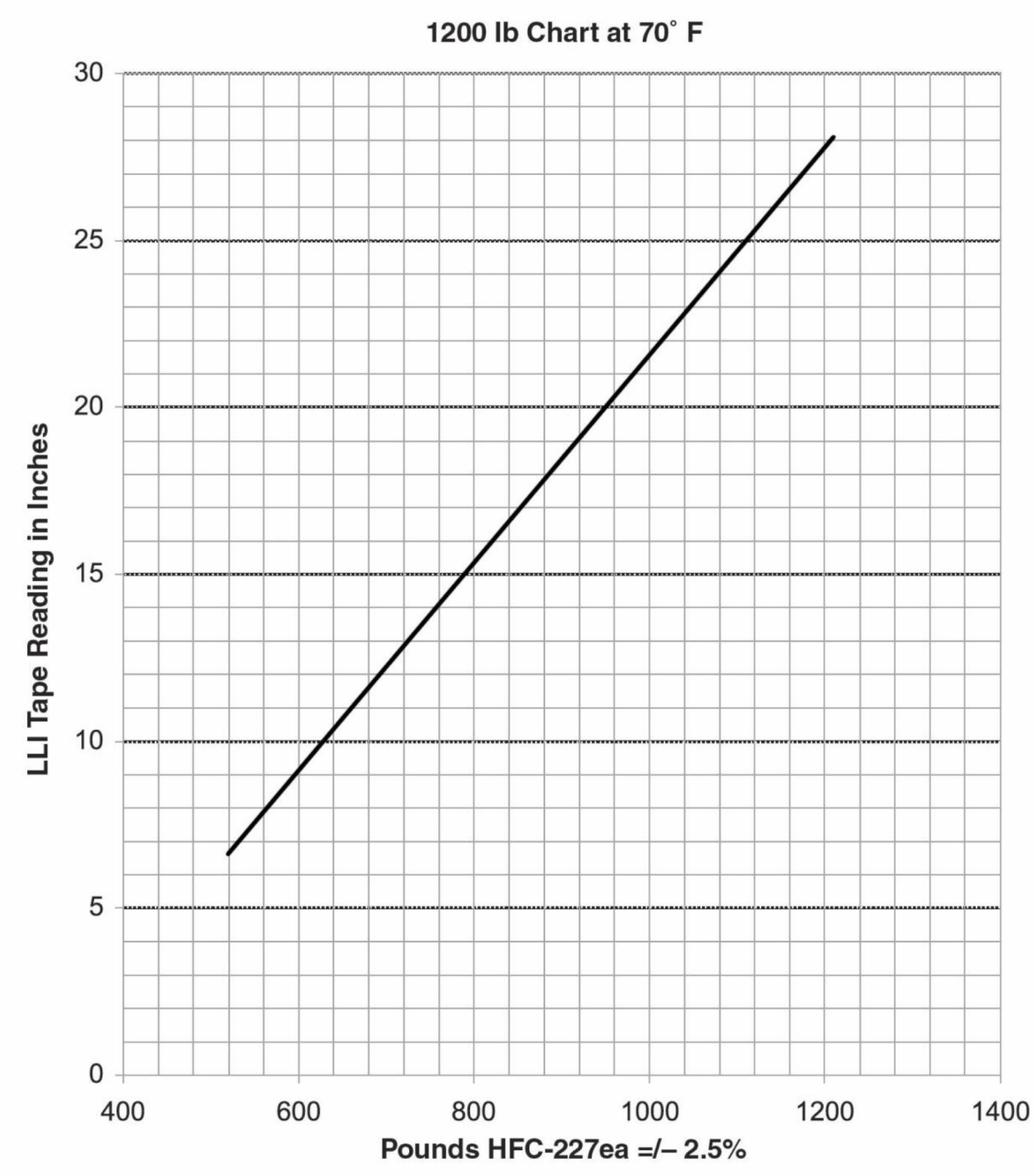


Figure 42: LLI Tape Reading (in cm) versus Weight of HFC-227ea (in kg) for 150 lb Cylinder

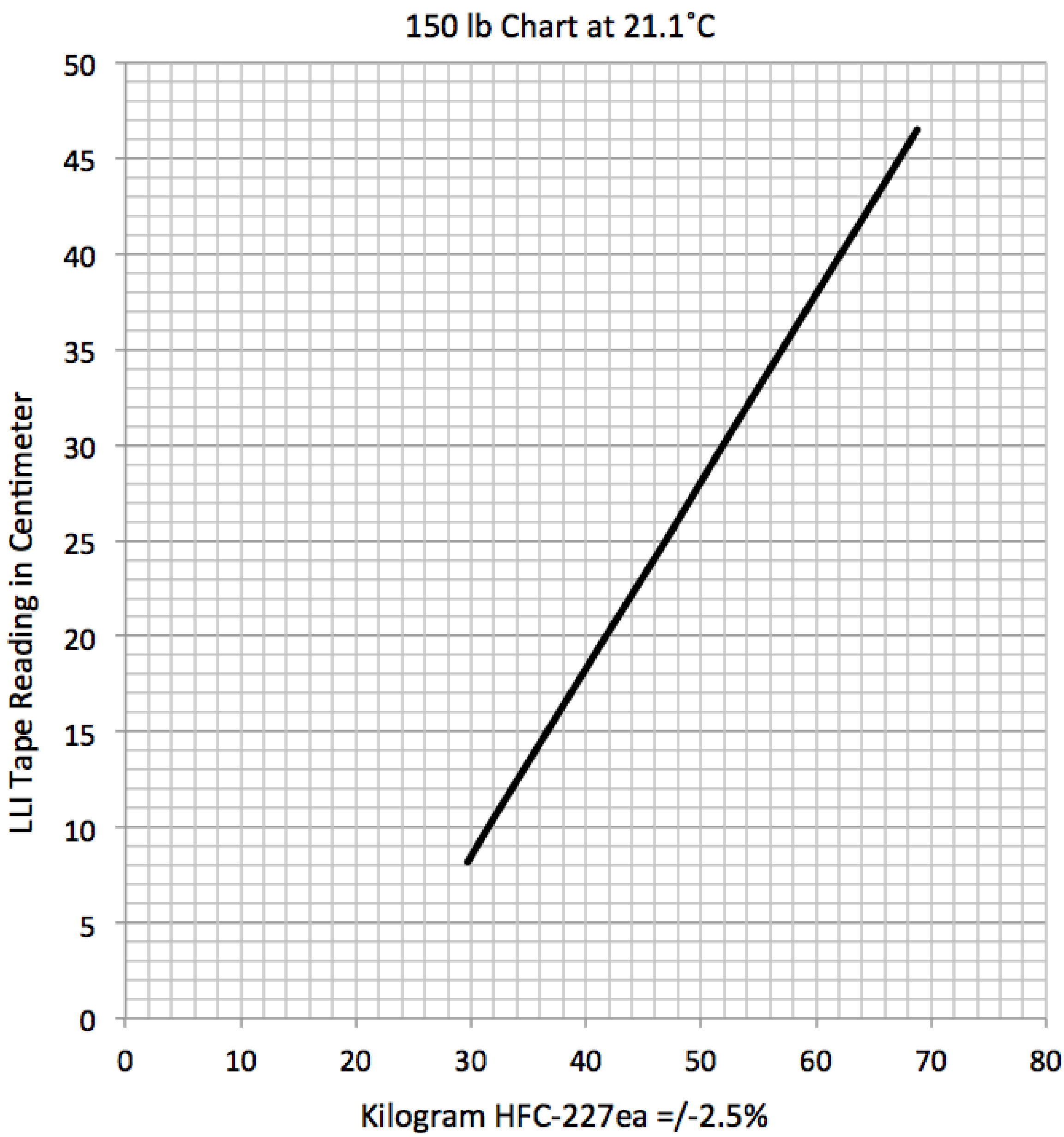


Figure 43: LLI Tape Reading (in cm) versus Weight of HFC-227ea (in kg) for 250 lb Cylinder

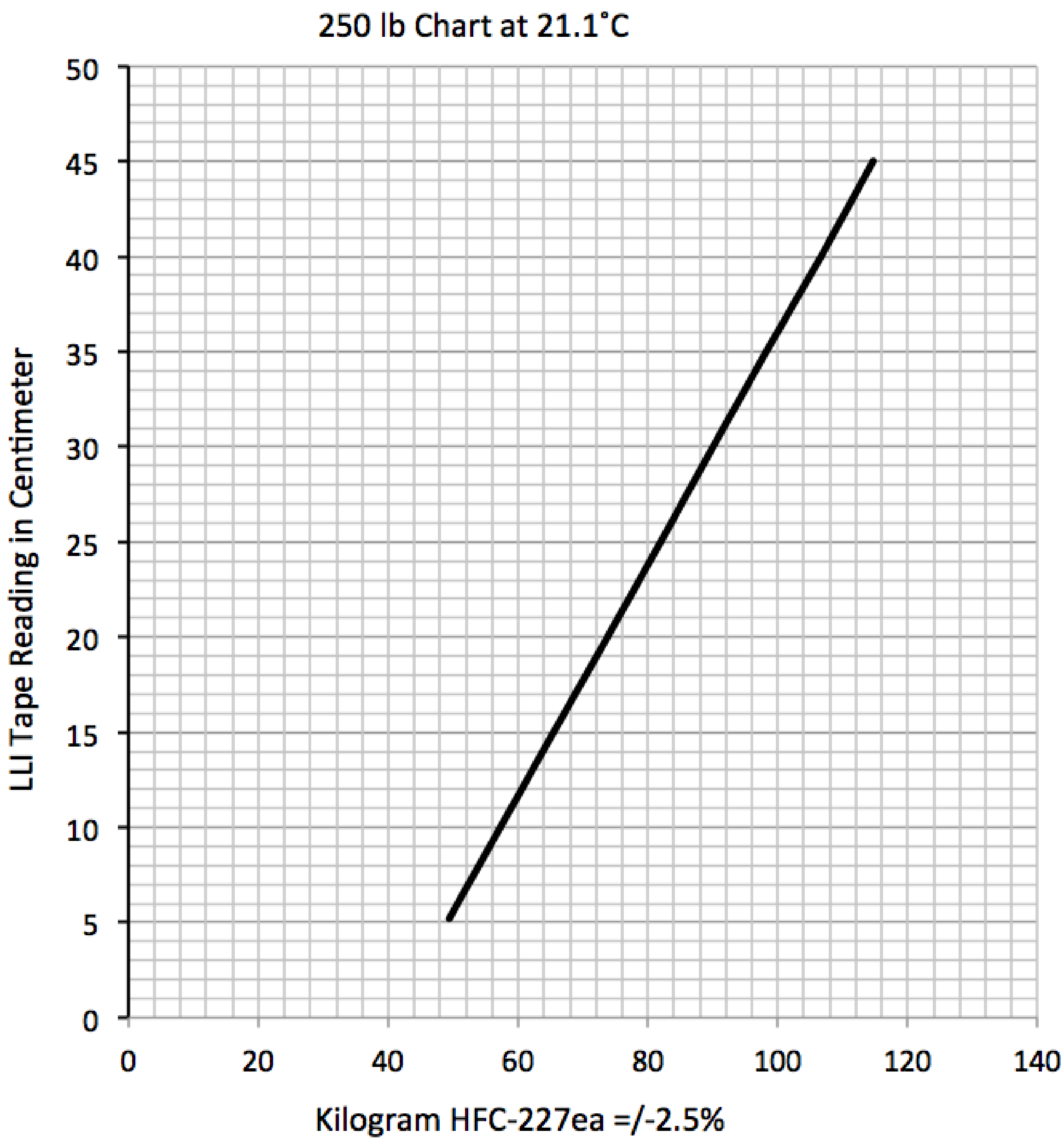


Figure 44: LLI Tape Reading (in cm) versus Weight of HFC-227ea (in kg) for 375 lb Cylinder

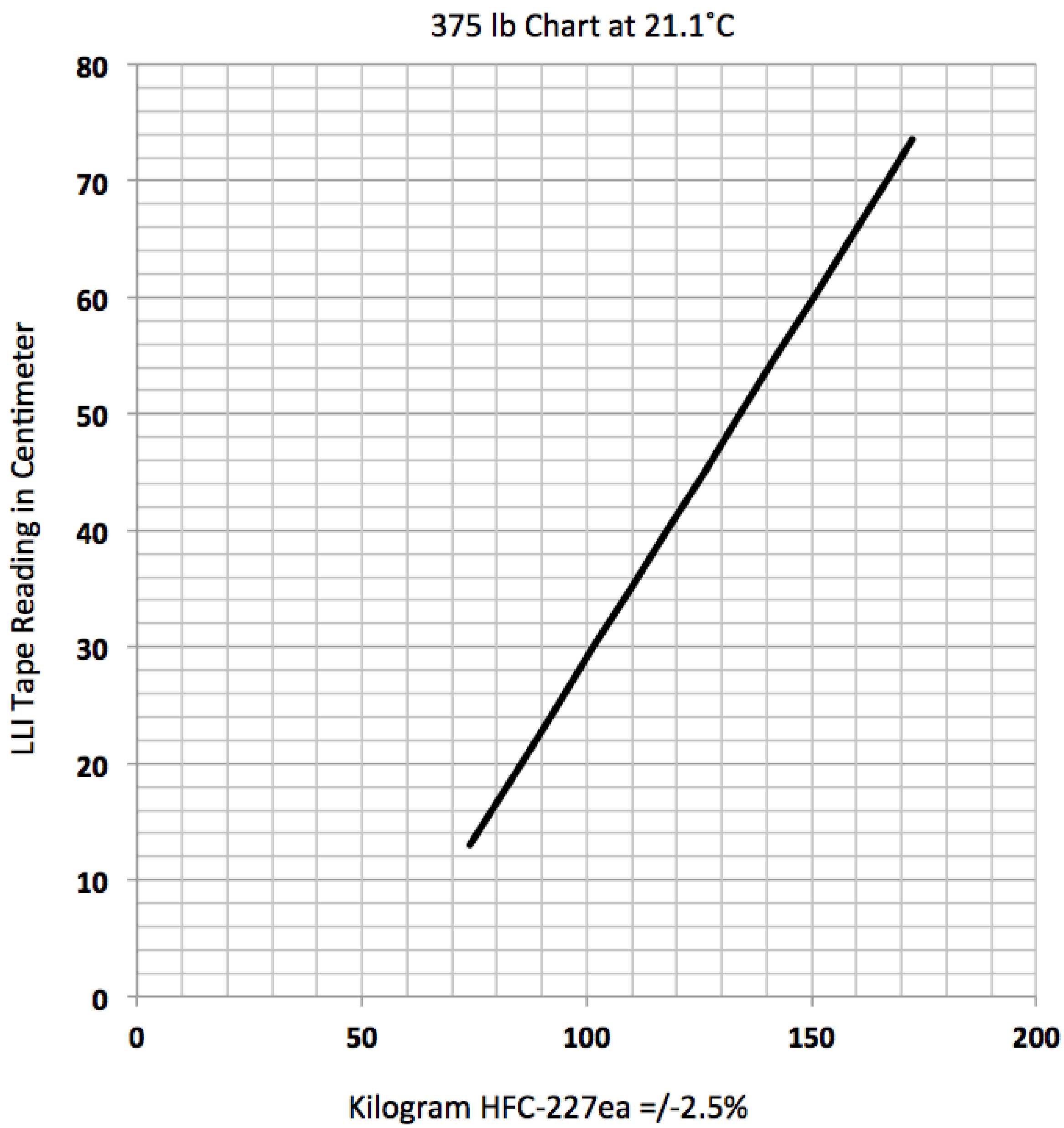


Figure 45: LLI Tape Reading (in cm) versus Weight of HFC-227ea (in kg) for 560 lb Cylinder

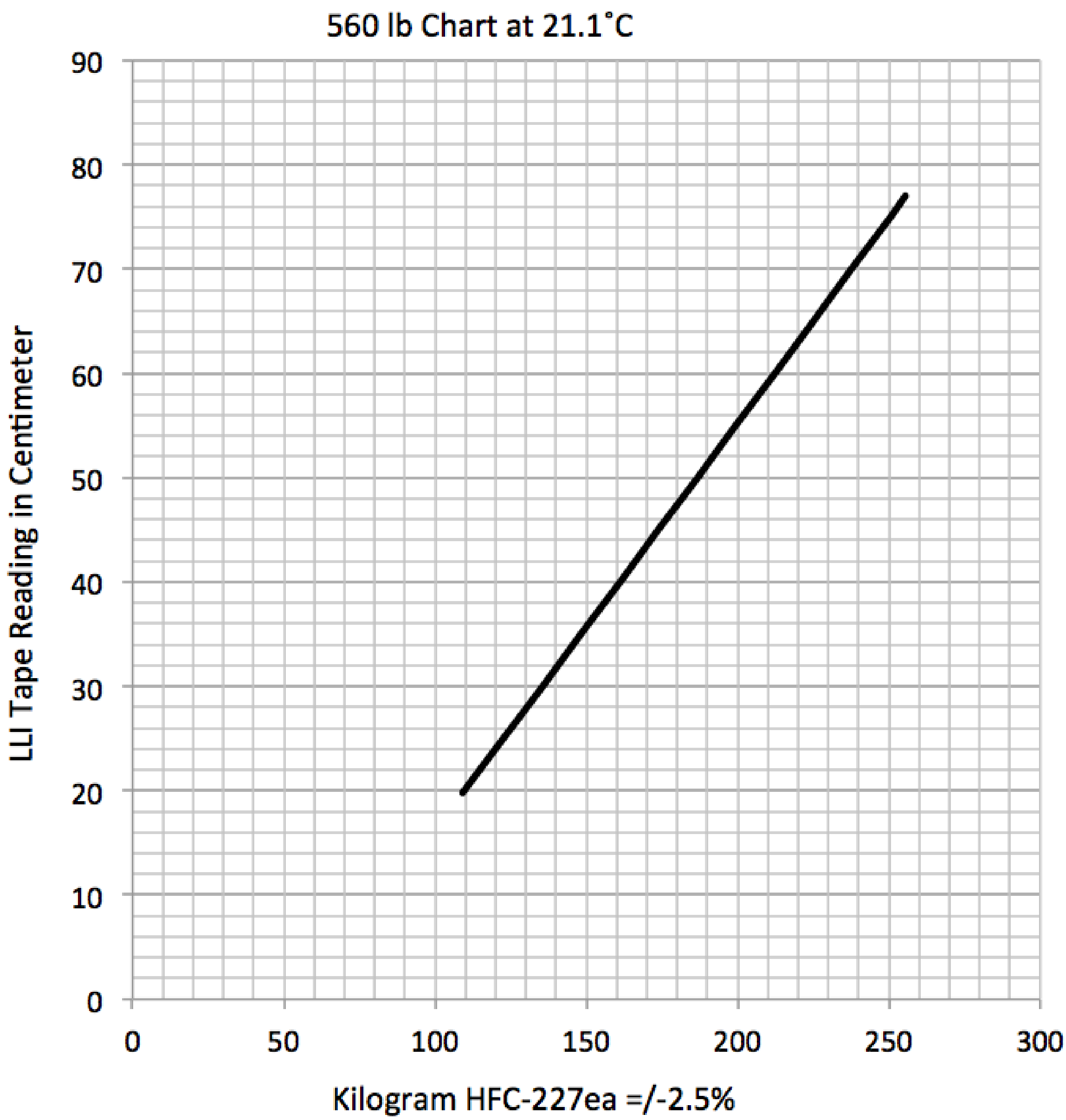
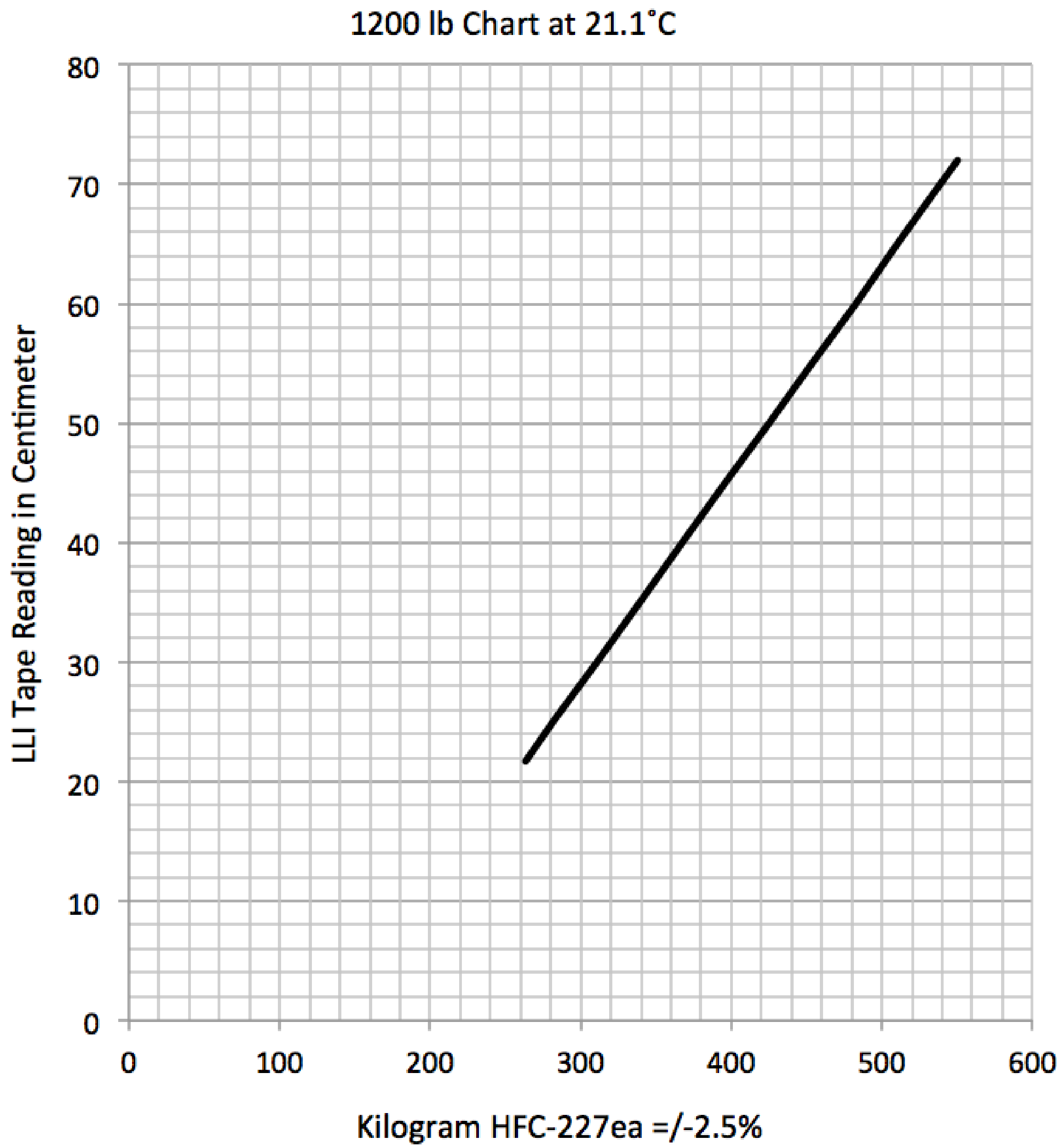


Figure 46: LLI Tape Reading (in cm) versus Weight of HFC-227ea (in kg) for 1200 lb Cylinder



3 System Design

3.1 Introduction

The design section provides an understanding of the characteristics of HFC-227ea in relation to its flow from its storage container, through the piping network, and discharging from the distribution nozzles. Information is also given for the "Authorities Having Jurisdiction" for approving the system installation. Systems shall be installed and maintained in accordance to the NFPA 2001 and this manual. The calculation method has been investigated for the specific types of pipe, fittings and pipe I.D. If the application does violate the limitations mentioned in this Chapter, there is a risk that the system will not supply the designated quantity of agent.

The flow of HFC-227ea through the discharge piping is a complex two-phase flow. The Context Plus HFC-227ea Engineered Systems have been investigated and comply with the UL 2166 Test Standards for Clean Agents. The NFPA 2001 Standards shall be followed by the system designer. The latest edition of NFPA 2001 is available from National Fire Protection Association, Batterymarch Park, Quincy, MA-02269.

The Context Plus HFC-227ea system is designed for total flooding applications to extinguish Class A, B and C type fires. It is important that every system is designed to provide the maximum extinguishing characteristics and that the limitations for total flooding are strictly followed.

3.2 Defining Scope of Protection

Before making any calculation, the following must be known. This will provide the design parameters to protect the hazard.

a) The Hazard Class: A, B, C.
   Note: Class A fires are those, which involve ordinary combustible materials, such as wood, cloth, paper, rubber, plastics and other cellulose-type materials. Refer to the NFPA 2001 (2004 edition).
b) Power is to be effectively shut down at system discharge. If power cannot be shut down, the hazard should be classifies as Class C.
c) The volumes, areas, measurements of the hazard that are used for Class A hazards are the same as for those of Class B and C hazards.
d) Based on the class of fire, the minimum design concentration by volume will be assigned as the followings. See Section 1.4 for more details.

NOTE:

1) **The minimum design concentration for total flooding applications of HFC-227ea is 6.25% for Class A materials in accordance with NFPA 2001, unless a higher concentration is required for the specific hazard being protected.**
2) **Higher design concentrations are required for Class B fires. The minimum design concentration for the protection of all Class B hazards shall be 8.71% based on the UL 2166 total flooding test program.**
3) **The minimum design concentration for Class C hazards shall be at least that for Class A surface fires.**

e) Electrically non-conductive fire-extinguishing media is of importance.
f) Pressure Adjustment: The design quantity of HFC-227ea agent shall be adjusted to compensate for ambient pressures that vary more than 3000 ft of elevation from standard sea level. The atmospheric correction factor is provided in Table 13.
g) The minimum and maximum ambient temperature in the volume being protected.
h) The minimum and maximum temperature at which the HFC-227ea cylinders shall be stored when systems are unbalanced and protection against different hazards are 60 ^{o}F and 80 ^{o}F respectively.
i) The exact internal dimensions of the hazard in terms of length, width, and height.
j) Will materials, stock, etc. that accrue on a daily basis affect the volume in any appreciable amounts?
k) If any air handling equipment(s) is assigned to the hazard, review the equipment's capacity as to air changes per hour. The hold time of the agent after discharge must be taken into consideration.
l) When the calculation method is used for multiple hazards and the temperature of the cylinders varies ±10°F, there is a risk that the system will not supply the required quantity of fire-extinguishing agent.

When the system is discharged into a complete enclosure, normal cracks and gaps under doorways shall not impact system performance. If there are openings in the volume, they must be sealed. Doors and normal vents that are required in the enclosure must be closed prior to, or at the time of discharge. Doors or closures that normally swing to a closed position and are not held open, or will not be opened when the HFC-227ea is discharged, need no system generated mechanism to make them close. Doors and closures including ventilation that is held open or operating must have devices installed to shut them off at the beginning or before system discharge. Doors should be closed and ventilation fans shut down prior to discharge.

Table 14: Atmospheric Correction Factor

Altitude	Enclosure Pressure	Correction Factor
-3,000 ft (-0.91 km)	16.25 psia (84.0 cmHg)	1.11
-2,000 ft (-0.61 km)	15.71 psia (81.2 cmHg)	1.07
-1,000 ft (-0.30 km)	15.23 psia (78.8 cmHg)	1.04
0	14.71 psia (76.1 cmHg)	1.00
1,000 ft (0.30 km)	14.18 psia (73.3 cmHg)	0.96
2,000 ft (0.61 km)	13.64 psia (70.5 cmHg)	0.93
3,000 ft (0.91 km)	13.12 psia (67.8 cmHg)	0.89
4,000 ft (1.22 km)	12.58 psia (65.1 cmHg)	0.86
5,000 ft (1.52 km)	12.04 psia (62.3 cmHg)	0.82
6,000 ft (1.83 km)	11.53 psia (59.6 cmHg)	0.78
7,000 ft (2.13 km)	11.03 psia (57.0 cmHg)	0.75
8,000 ft (2.43 km)	10.64 psia (55.0 cmHg)	0.72
9,000 ft (2.74 km)	10.22 psia (52.9 cmHg)	0.69
10,000 ft (3.05 km)	9.77 psia (50.5 cmHg)	0.66

3.3 Amount of Agent Required

Following is an example of a hazard with a three nozzles engineered system. The system is for the protection of equipment. Table 14 shows the amount in pounds per cubic foot of HFC-227ea required for a specific concentration at a specific temperature.

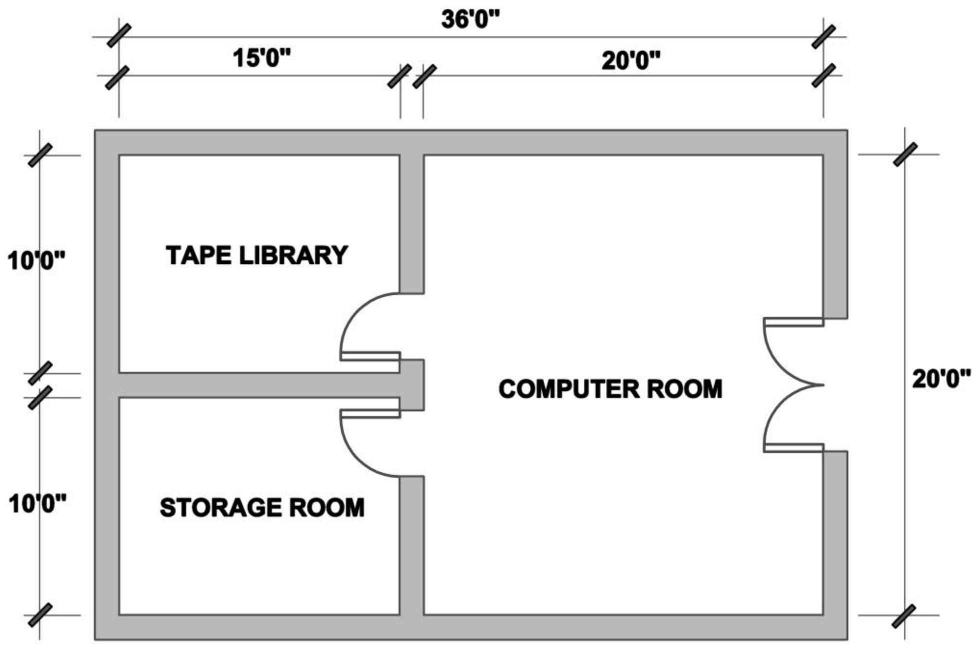
Table 15: Amount of HFC-227ea Clean Agent Required for a Specific Concentration at a Specific Time

Amount of HFC-227ea Agent Required
HFC-227ea Weight Requirements of Hazard Volume W/V (lb/cu ft)
Design Concentration (% by Volume)

Temp. -t- (º F)	Specific Vapor Volume (cu ft/lb) - S -	6.25	7	8	9	10	11	12	13
10	1.9264	0.0346	0.0391	0.0451	0.0513	0.0577	0.0642	0.0708	0.0776
20	1.9736	0.0337	0.0381	0.0441	0.0501	0.0563	0.0626	0.0691	0.0757
30	2.0210	0.0329	0.0372	0.0430	0.0489	0.0550	0.0612	0.0675	0.0739
40	2.0678	0.0322	0.0364	0.0421	0.0478	0.0537	0.0598	0.0659	0.0723
50	2.1146	0.0315	0.0356	0.0411	0.0468	0.0525	0.0584	0.0645	0.0707
60	2.1612	0.0308	0.0348	0.0402	0.0458	0.0514	0.0572	0.0631	0.0691
70	2.2075	0.0302	0.0341	0.0394	0.0448	0.0503	0.0560	0.0618	0.0677
80	2.2538	0.0295	0.0334	0.0386	0.0439	0.0493	0.0548	0.0605	0.0663
90	2.2994	0.0289	0.0327	0.0378	0.0430	0.0483	0.0538	0.0593	0.0650
100	2.3452	0.0284	0.0321	0.0371	0.0422	0.0474	0.0527	0.0581	0.0637
110	2.3912	0.0278	0.0315	0.0364	0.0414	0.0465	0.0517	0.0570	0.0625
120	2.4366	0.0273	0.0309	0.0357	0.0406	0.0456	0.0507	0.0560	0.0613
130	2.4820	0.0268	0.0303	0.0350	0.0398	0.0448	0.0498	0.0549	0.0602
140	2.5272	0.0263	0.0298	0.0344	0.0391	0.0440	0.0489	0.0540	0.0591
150	2.5727	0.0259	0.0293	0.0338	0.0384	0.0432	0.0480	0.0530	0.0581

At 70°F and 7% concentration, the value used is 0.0341 lb/ft^3. In order to determine the quantity of agent required, multiply the volume of the hazard by the factor 0.0341.

Figure 47: The Size of Rooms



Room Specifications:

- Length (L): 20 ft
- Width (W): 20 ft
- Height (H): 8 ft
- Concentration: 7% for Class A Hazard
- Minimum ambient temperature: 70 °F
- The room is normally occupied.
- The room is divided into 3 sections, namely computer room, tape library, and storage room.

Section I: Computer Room

- A = L x W
- A = 20 ft x 20 ft = 400 ft^2
- V = H x A
- V = 8 ft x 400 ft^2 = 3200 ft^3
- HFC-227ea required = 3200 ft^3 x 0.0341 lb/ft^3 = 109.12 lb (minimum amount)

Section II: Tape Library

- A = L x W
- A = 15 ft x 10 ft = 150 ft^2
- V = H x A
- V = 8 ft x 150 ft^2 = 1200 ft^3
- HFC-227ea required = 1200 ft^3 x 0.0341 lb/ft^3 = 40.92 lb (minimum amount)

Section III: Storage Room

- A = L x W
- A = 15 ft x 10 ft = 150 ft^2
- V = H x A
- V = 8 ft x 150 ft^2 = 1200 ft^3
- HFC-227ea required = 1200 ft^3 x 0.0341 lb/ft^3 = 40.92 lb (minimum amount)

In summary,

Table 16: Amount in Pounds per Cubic Foot of HFC-227ea Required for a Specific Concentration at a Specific Temperature

Section	Minimum Agent Required	Adjusted Amount
I Computer Room	109.12 lb	110 lb
II Tape Library	40.92 lb	41 lb
III Storage Room	40.92 lb	41 lb

The minimum amount of agent required is 192 lb. Therefore, one 250 lb cylinder filled to 197 lb of HFC-227ea shall be used.

Note: The agent required is rounded up to a whole number when determining the fill for the cylinder.

In case of the design quantity of HFC-227ea agent shall be adjusted to compensate for ambient pressures that vary more than 3000 ft of elevation from standard sea level, the agent required is determined by the following formula:

$$W = C.F.* \left(\frac{V}{S}\left(\frac{C}{100 - C}\right)\right)$$

where:

W = mass of HFC-227ea (lb)

C.F. = atmospheric correction factor (see Table 14)

V = volume of the hazard area (ft^3)

S = specific volume (ft^3/lb)

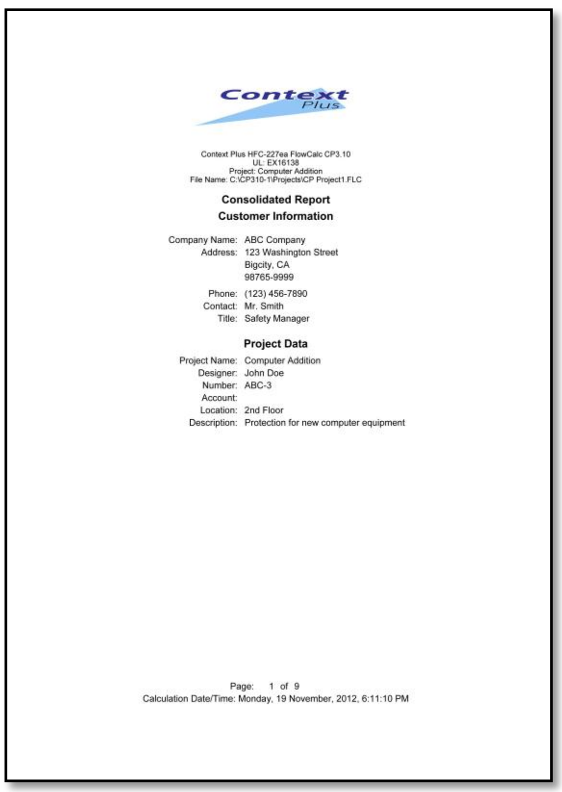
C = volumetric concentration of HFC-227ea in air at the specific temperature (%)

Note:

1) **Specific volume of superheated HFC-227ea vapor may be approximated by the formula: *S* = 1.885 + 0.0046*t* where *t* = ambient temperature (^{o}F) in the protected space**
2) **The agent required must be based on the lowest expected ambient temperature in the protected space. Care must be taken that the calculated concentration for normally occupied spaces at the highest expected ambient temperature in the protected space does not exceed 10.5% v/v per NFPA 2001.**
3) **This calculation includes an allowance for the normal leakage from a "tight" enclosure due to agent expansion.**
4) **The formula for determining the amount of HFC-227ea is from Table 14. This can also be accomplished by using the Computer Software Program, by using the input section under Enclosure Information and supplying the design criteria and hazard configuration. The computer program will automatically calculate each hazard area and then summarize the total agent requirements.**

The following figures are the output statements for the hazard example. They are for reference only. See the software instructions for further details.

Figure 48: Flow Calculation Example - Output Statement



Context Plus HFC-227ea FlowCalc CP3.10
UL: EX16138
Project: Computer Addition
File Name: C:\CP310-1\Projects\CP Project1.FLC

Consolidated Report

Customer Information

Company Name: ABC Company
Address: 123 Washington Street
Bigcity, CA
98765-9999

Phone: (123) 456-7890
Contact: Mr. Smith
Title: Safety Manager

Project Data

Project Name: Computer Addition
Designer: John Doe
Number: ABC-3
Account:
Location: 2nd Floor
Description: Protection for new computer equipment

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Consolidated Report
Enclosure Information

Elevation: 0 ft (relative to sea level)
Atmospheric Correction Factor: 1

Enclosure Number: 1
Name: Front Computer Room
Enclosure Temperature...
Minimum: 70 F
Maximum: 70 F
Maximum Concentration: 7.204 %
Design Concentration...
Adjusted: 7.204 %
Minimum: 7.000 %
Minimum Agent Required: 109.2 lbs

Width: 0.0 ft
Length: 0.0 ft
Height: 0.0 ft

Volume: 3201.0 cubic ft
Non-permeable: 0.0 cubic ft

Total Volume: 3201.0 cubic ft

Adjusted Agent Required: 112.6 lbs
Number of Nozzles: 1

Enclosure Number: 2
Name: Section II
Enclosure Temperature...
Minimum: 70 F
Maximum: 70 F
Maximum Concentration: 7.218 %
Design Concentration...
Adjusted: 7.218 %
Minimum: 7.000 %
Minimum Agent Required: 41.0 lbs

Width: 10.0 ft
Length: 15.0 ft
Height: 8.0 ft

Volume: 1200.0 cubic ft
Non-permeable: 0.0 cubic ft

Total Volume: 1200.0 cubic ft

Adjusted Agent Required: 42.3 lbs
Number of Nozzles: 1

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Consolidated Report
Enclosure Information

Elevation: 0 ft (relative to sea level)
Atmospheric Correction Factor: 1

Enclosure Number: 3
Name: Section III
Enclosure Temperature...
Minimum: 70 F
Maximum: 70 F
Maximum Concentration: 7.186 %
Design Concentration...
Adjusted: 7.186 %
Minimum: 7.000 %
Minimum Agent Required: 41.0 lbs

Width: 10.0 ft
Length: 15.0 ft
Height: 8.0 ft

Volume: 1200.0 cubic ft
Non-permeable: 0.0 cubic ft

Total Volume: 1200.0 cubic ft

Adjusted Agent Required: 42.1 lbs
Number of Nozzles: 1

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Consolidated Report
Agent Information

Agent: HFC-227ea / Propellant N2

Adjusted Agent Required: 197.0 lbs
Cylinder Name: 250 lb. Cylinder
Cylinder Part Number: CP90250-E
Number of Main Cylinders: 1
Number of Reserve Cylinders: 0
Manifold: No Manifold

Pipe Take Off Direction: Horizontal
Agent Per Cylinder: 197.0 lbs
Fill Density: 54.4 lbs / cubic ft
Cylinder Empty Weight: 154.8 lbs
Weight, All Cylinders + Agent: 351.8 lbs
Floor Area Per Cylinder: 1.40 square ft
Floor Loading Per Cylinder: 252 lbs / square ft

Pipe Network

Part 1 - Pipe

Description	Start	End	Type	Pipe Diameter	Pipe Length	Elevation
Main Cyl. X 1	0	1		1-1/2 in	3.19 ft	3.19 ft
Pipe	1	2	40T	1-1/2 in	1.00 ft	0.00 ft
Pipe	2	3	40T	1-1/2 in	5.00 ft	5.00 ft
Pipe	3	4	40T	1-1/2 in	10.00 ft	0.00 ft
Pipe	4	5	40T	1 in	5.00 ft	0.00 ft
Pipe	5	6	40T	3/4 in	5.00 ft	0.00 ft
Pipe	6	7	40T	3/4 in	1.00 ft	0.00 ft
Pipe/E3-N1	7	8	40T	3/4 in	1.00 ft	-1.00 ft
Pipe	5	9	40T	3/4 in	5.00 ft	0.00 ft
Pipe	9	10	40T	3/4 in	1.00 ft	0.00 ft
Pipe/E2-N1	10	11	40T	3/4 in	1.00 ft	-1.00 ft
Pipe	4	12	40T	1-1/2 in	5.00 ft	0.00 ft
Pipe/E1-N1	12	13	40T	1-1/2 in	1.00 ft	-1.00 ft

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Consolidated Report

Part 2 - Equivalent Length

Start	End	90	45	Thru	Side	Union	Other	Added	Total
0	1	0	0	0	0	0		0.00 ft	28.3 ft
1	2	0	0	0	0	0		0.00 ft	1.0 ft
2	3	1	0	0	0	0		0.00 ft	9.3 ft
3	4	1	0	0	0	0		0.00 ft	14.3 ft
4	5	0	0	0	1	0		0.00 ft	10.7 ft
5	6	0	0	0	1	0		0.00 ft	9.5 ft
6	7	1	0	0	0	0		0.00 ft	3.2 ft
7	8	1	0	0	0	0		0.00 ft	3.2 ft
5	9	0	0	0	1	0		0.00 ft	9.5 ft
9	10	1	0	0	0	0		0.00 ft	3.2 ft
10	11	1	0	0	0	0		0.00 ft	3.2 ft
4	12	0	0	0	1	0		0.00 ft	13.7 ft
12	13	1	0	0	0	0		0.00 ft	5.3 ft

Part 3 - Nozzles

Start	End	Flow	Name	Size	Type	Nozzle Area
0	1	197.0 lbs				
1	2	197.0 lbs				
2	3	197.0 lbs				
3	4	197.0 lbs				
4	5	84.4 lbs				
5	6	42.1 lbs				
6	7	42.1 lbs				
7	8	42.1 lbs	E3-N1	3/4 in	Central	0.3802 square in
5	9	42.3 lbs				
9	10	42.3 lbs				
10	11	42.3 lbs	E2-N1	3/4 in	Central	0.3802 square in
4	12	112.6 lbs				
12	13	112.6 lbs	E1-N1	1-1/2 in	Central	0.6555 square in

Parts Information

Total Agent Required: 197.0 lbs
Cylinder Name: 250 lb. Cylinder (Part: CP90250-E)
Number Of Cylinders: 1
Field1

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Nozzle	Type	Diameter	Nozzle Area	Part Number
E1-N1	Central	1-1/2 in	0.6555 square in	CP 60708-3-0.3230
E2-N1	Central	3/4 in	0.3802 square in	CP 60705-3-0.2460
E3-N1	Central	3/4 in	0.3802 square in	CP 60705-3-0.2460

Nozzle	Drill Diameter	Drill Size
E1-N1	0.3230 inches	0.323
E2-N1	0.2460 inches	0.246
E3-N1	0.2460 inches	0.246

Pipe:	Type	Diameter	Length
	40T	3/4 in	14.00 ft
	40T	1 in	5.00 ft
	40T	1-1/2 in	22.00 ft

List of 90 degree elbows:
3 - 1-1/2 in
4 - 3/4 in

List of Tees:
1 - 1 in
1 - 1-1/2 in

System Acceptance

System Discharge Time: 9.6 seconds
Percent Agent In Pipe: 19.5%
Percent Agent Before First Tee: 12.1%

Enclosure Number: 1
Enclosure Name: Front Computer Room

Minimum Design Concentration: 7.000%
Adjusted Design Concentration: 7.204%
Predicted Concentration: 7.297%
Maximum Expected Agent Concentration: 7.297% (At 70 F)

Nozzle	Minimum Agent Required	Adjusted Agent Required	Predicted Agent Delivered	Nozzle Pressure (Average)
E1-N1	109.2 lbs	112.6 lbs	114.2 lbs	119 psig

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Enclosure Number: 2
Enclosure Name: Section II

Minimum Design Concentration: 7.000%
Adjusted Design Concentration: 7.218%
Predicted Concentration: 7.078%
Maximum Expected Agent Concentration: 7.078% (At 70 F)

Nozzle	Minimum Agent Required	Adjusted Agent Required	Predicted Agent Delivered	Nozzle Pressure (Average)
E2-N1	41.0 lbs	42.3 lbs	41.4 lbs	81 psig

Enclosure Number: 3
Enclosure Name: Section III

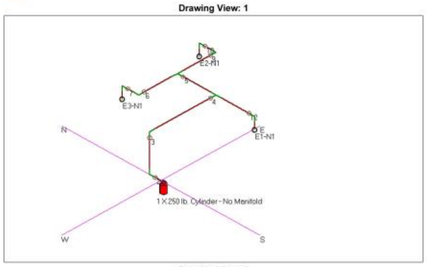
Minimum Design Concentration: 7.000%
Adjusted Design Concentration: 7.186%
Predicted Concentration: 7.078%
Maximum Expected Agent Concentration: 7.078% (At 70 F)

Nozzle	Minimum Agent Required	Adjusted Agent Required	Predicted Agent Delivered	Nozzle Pressure (Average)
E3-N1	41.0 lbs	42.1 lbs	41.4 lbs	81 psig

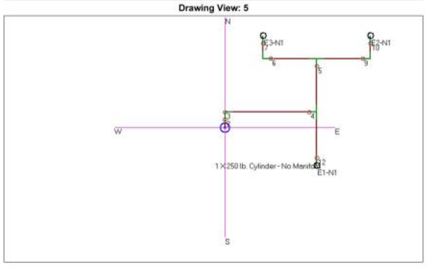
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Consolidated Report

Drawing View: 1



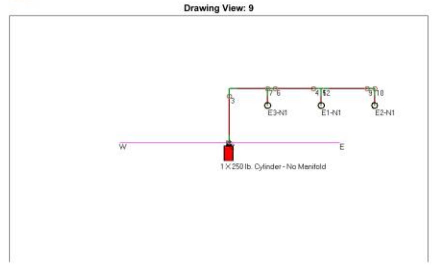
Drawing View: 5



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Drawing View: 9



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3.4 Cylinder(s) Configurations

Following are configurations for cylinder use in the engineered design method:

a) Single hazard with one cylinder and its piping and nozzle system.
b) Single hazard with multiple cylinders, each with their own piping and nozzle system.
c) Single hazard with multiple cylinders discharging through a common piping and nozzle system.
d) Multiple hazards with one cylinder discharging through its piping and nozzle system.
e) Multiple hazards with multiple cylinders discharging through a common piping and nozzle system.

3.5 Manifolding

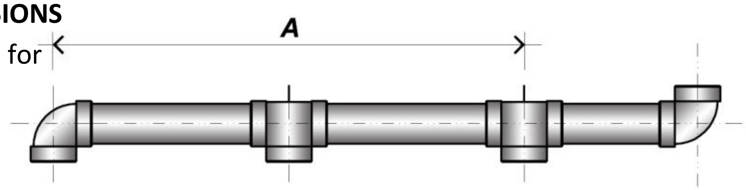
When required by hazard size, multiple cylinders may be manifolded together to feed the common piping network. Typical manifolds use threaded fittings (Figure 46), Victaulic fittings (Figure 47), and welded fittings. When installing Victaulic fittings manifold, only machined groove piping is to be used. Use one of these whenever manifolding is required and follow the guidelines listed below and sample illustrations.

Figure 49: Cylinder Manifolds (Screwed Type)

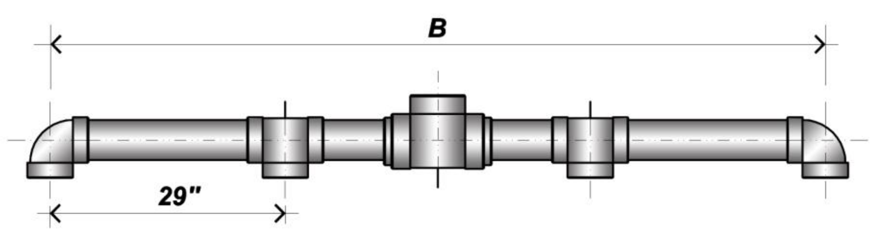
MANIFOLD DIMENSIONS

Wall Space required for Cylinder Storage.

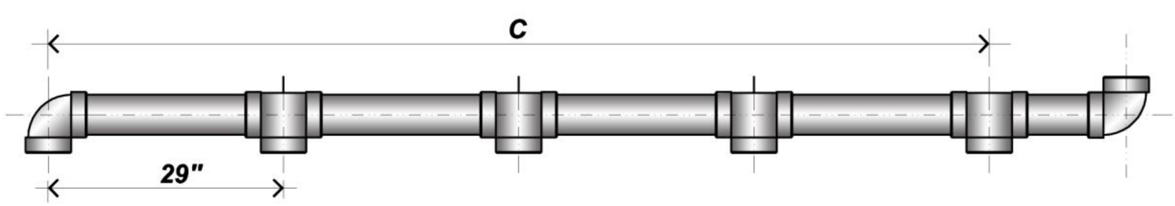
A. 4.83 ft
B. 7.25 ft
C. 9.67 ft



3 Cylinders Manifold (4" Piping, 5" Outlet)

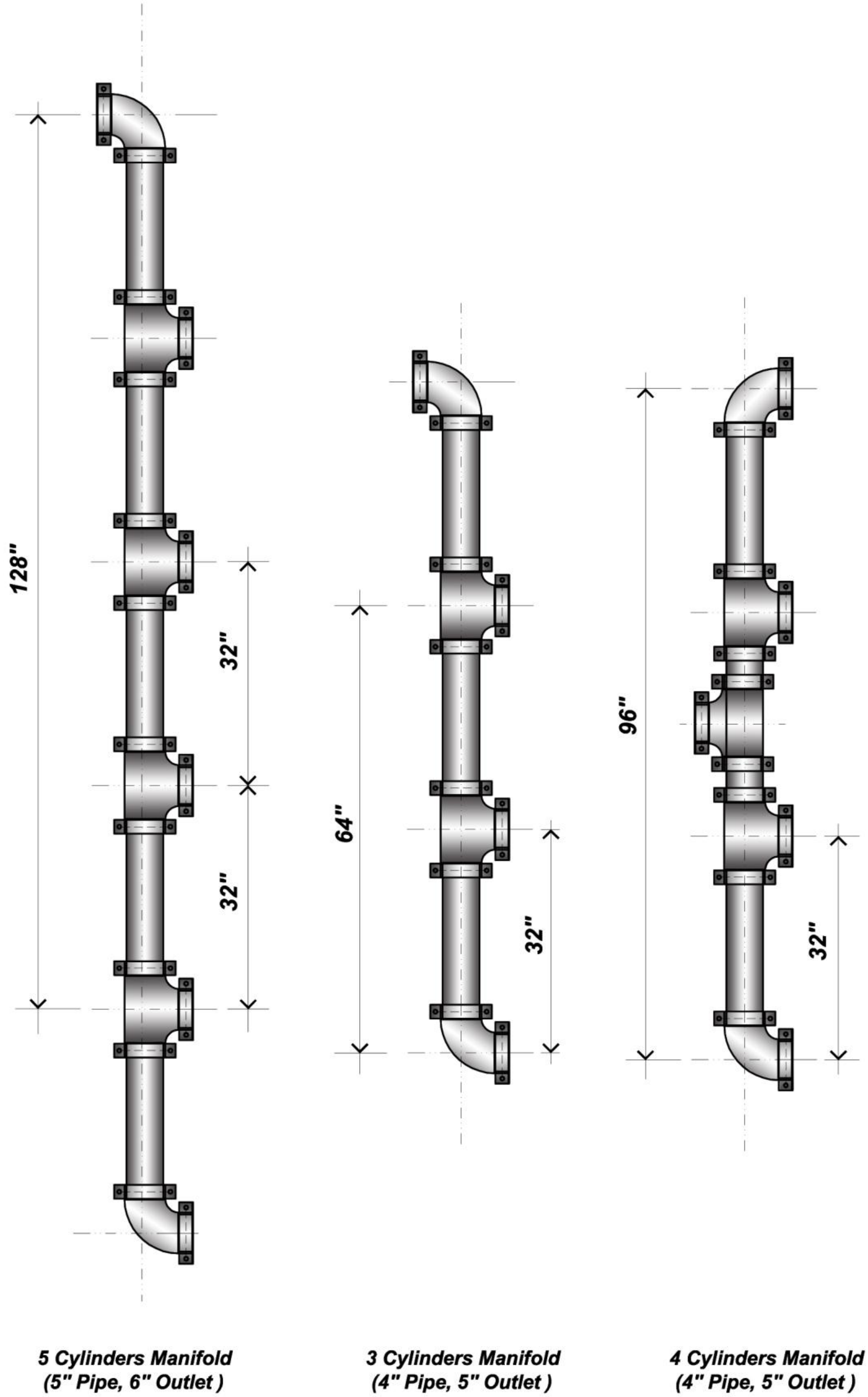


4 Cylinders Manifold (4" Piping, 5" Outlet)



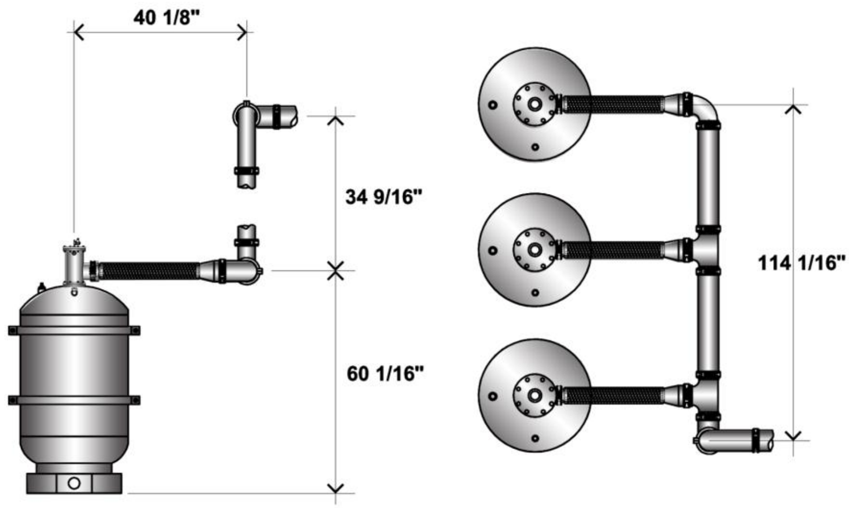
5 Cylinders Manifold (5" Piping, 6" Outlet)

Figure 50: Cylinder Manifolds (Victaulic Fittings)



For 1200 lb cylinder, the check valve can be installed horizontally or vertically (Figures 48 and 49). For other sizes, the check valve can only be installed vertically.

Figure 51: 1200 lb Cylinder Manifolds (Victaulic Fittings and Horizontal Outlet)



NOTE: The 4 inch check valve can be installed horizontally.

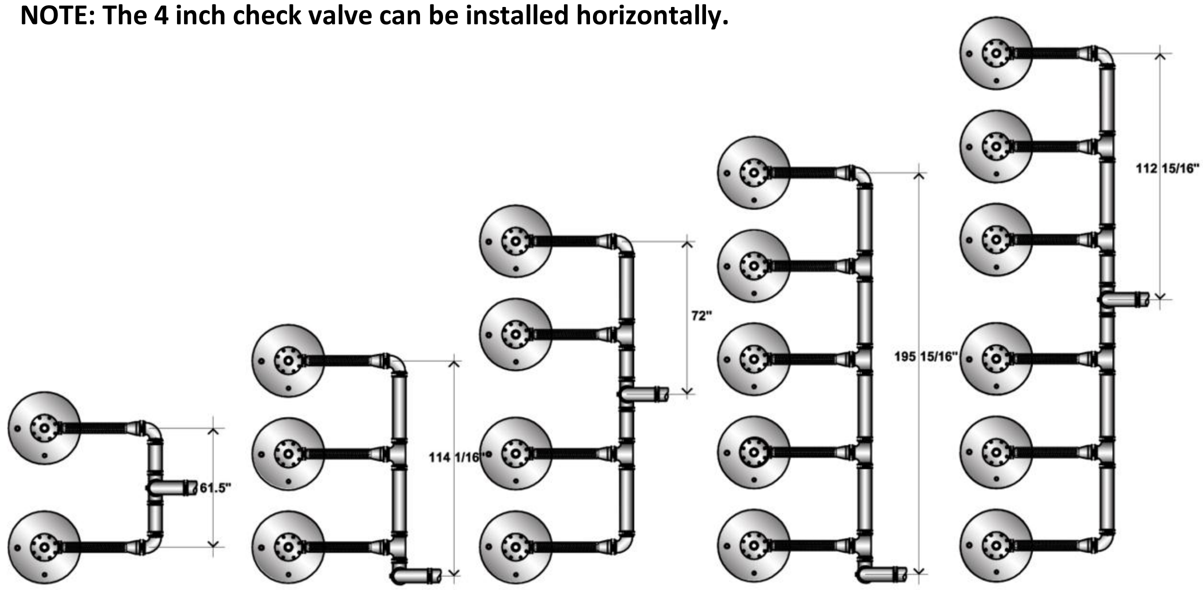
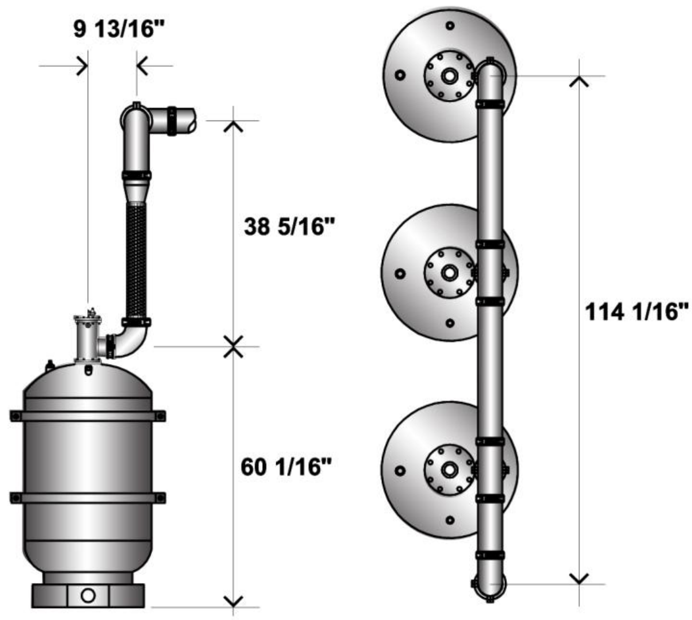
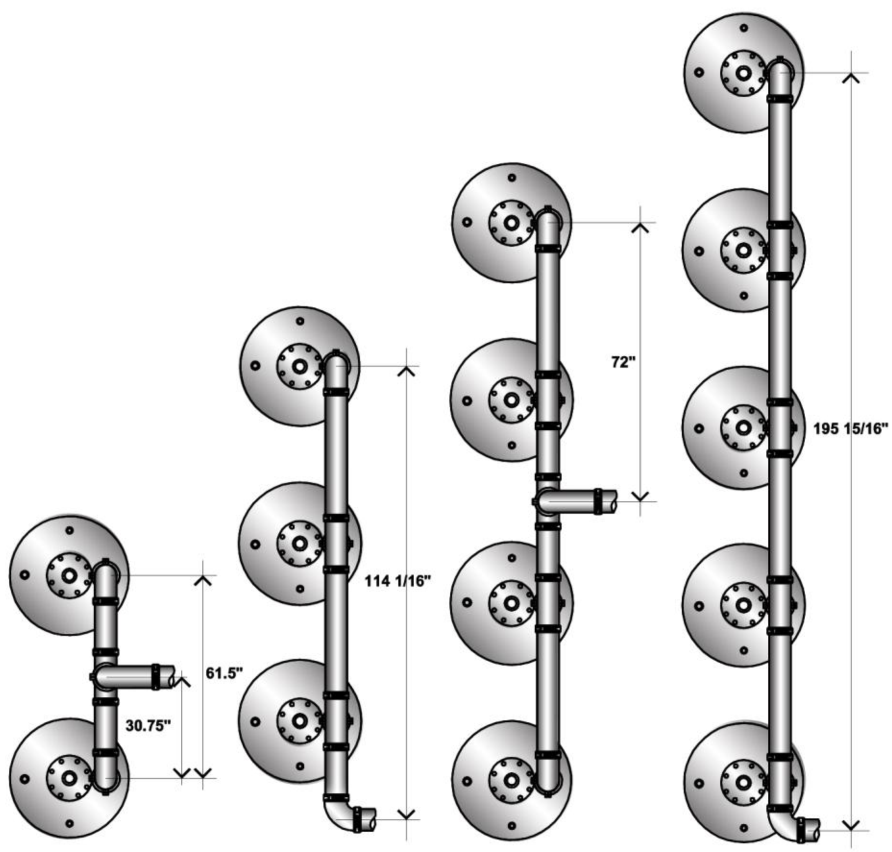
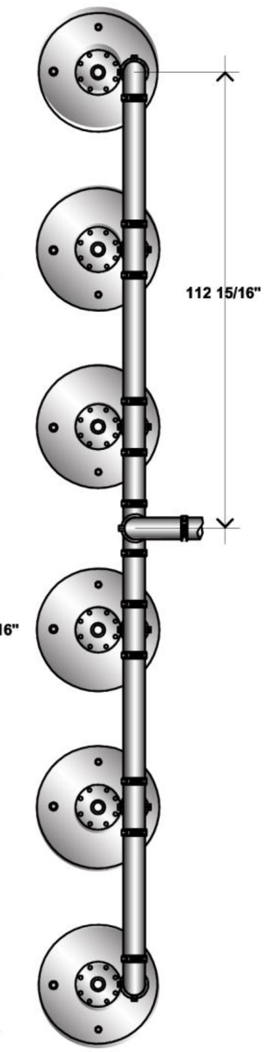


Figure 52: 1200 lb Cylinder Manifolds (Victaulic Fittings and Vertical Outlet)



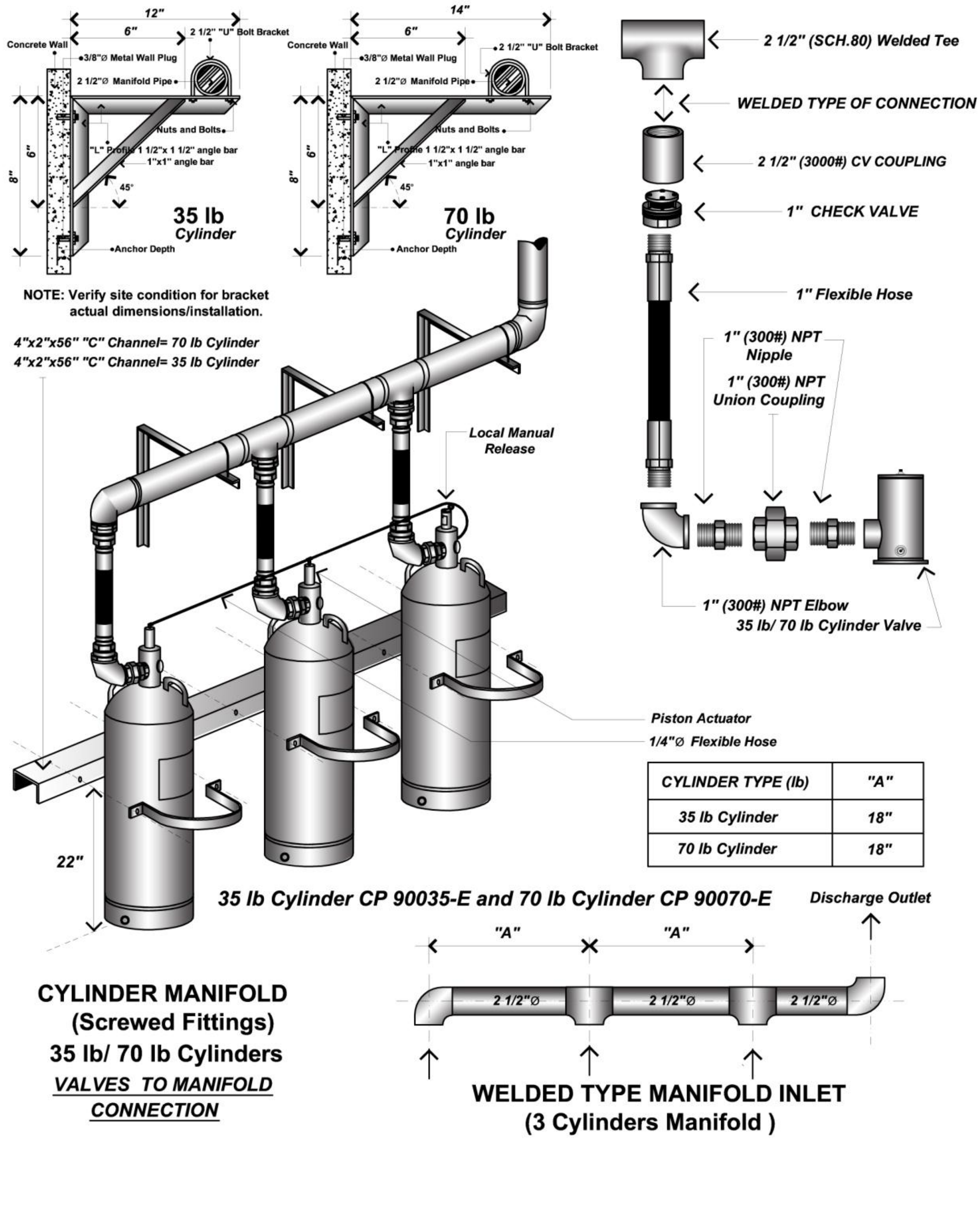
NOTE: The 4 inch check valve can be installed vertically.





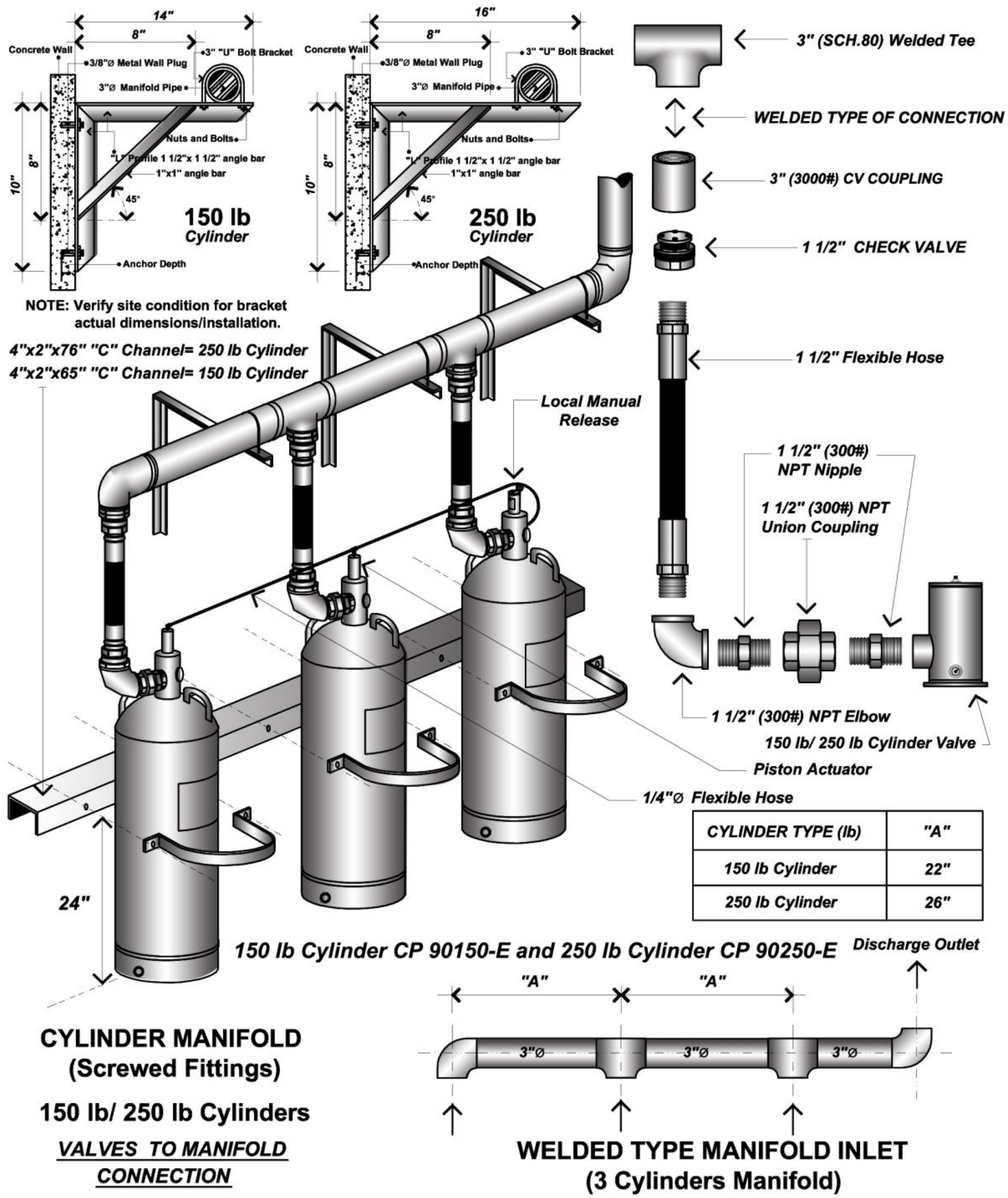
Alternatively, due to space constraint, the following examples (Figures 50 – 65) are provided.

Figure 53: Welded Type with Flexible Hose Manifold and Bracketing Details of CP 90035-E and CP 90070-E



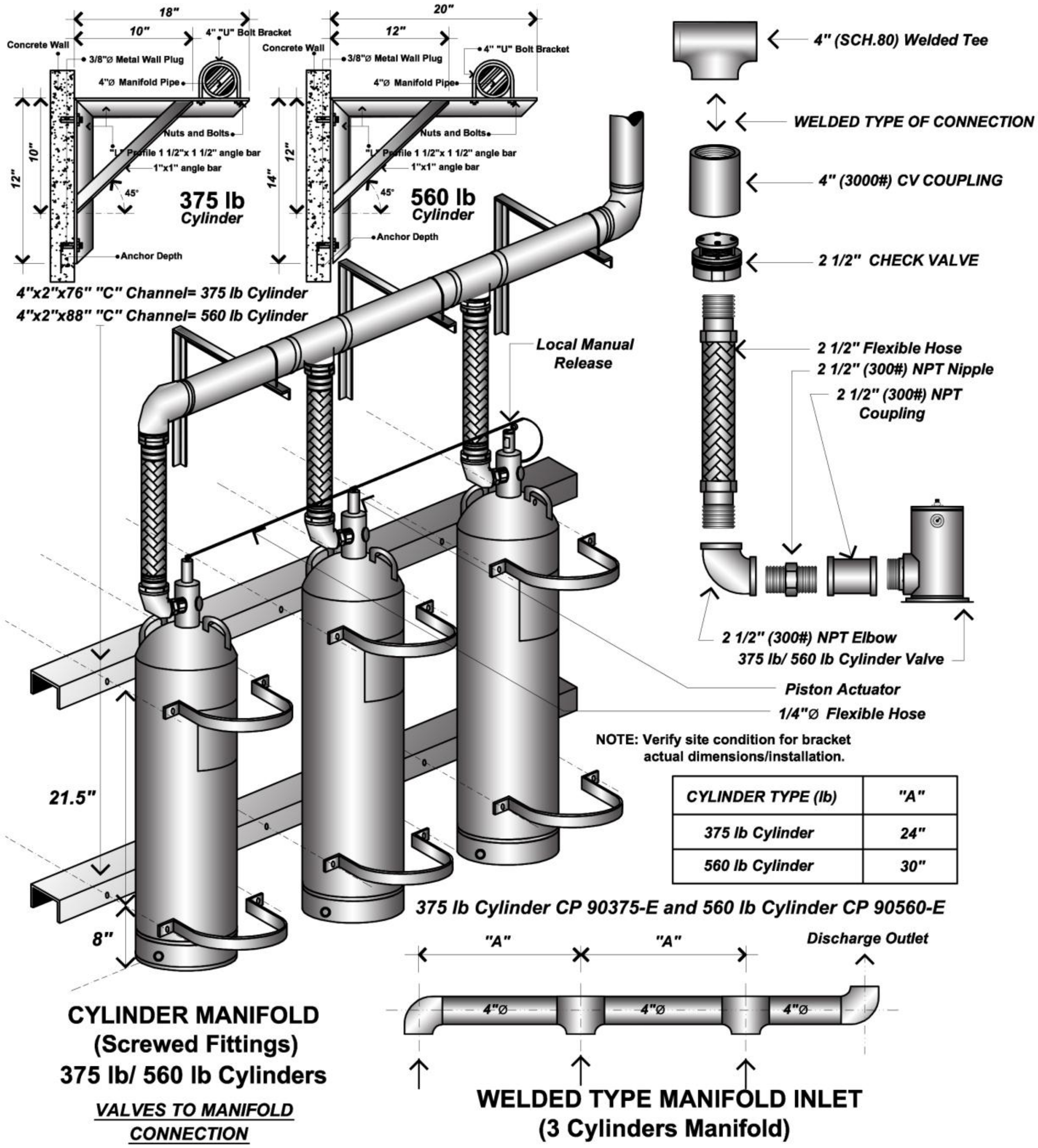
P/N: CP 202500

Figure 54: Welded Type with Flexible Hose Manifold and Bracketing Details of CP 90150-E and CP 90250-E



P/N: CP 202501

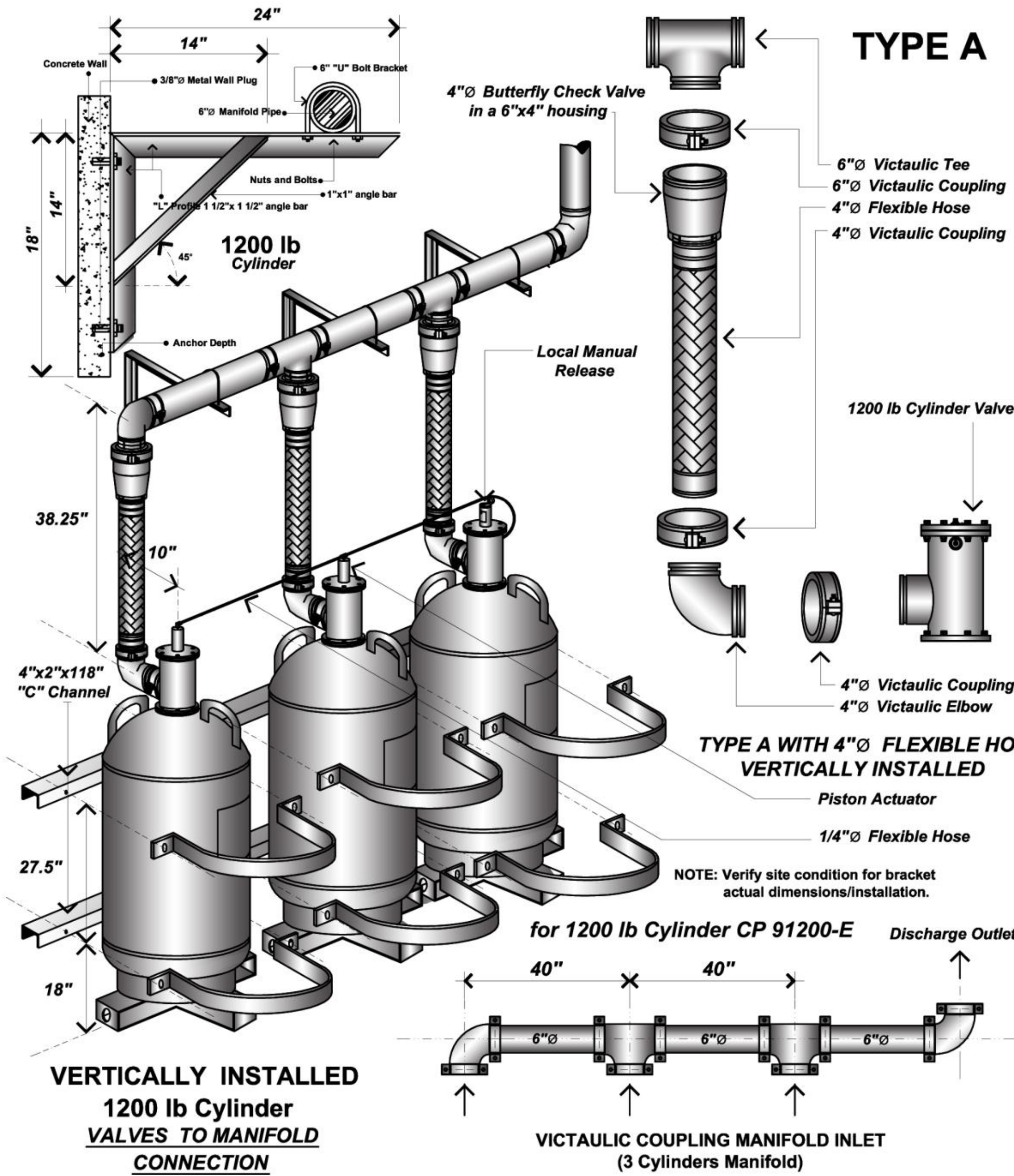
Figure 55: Welded Type with Flexible Hose Manifold and Bracketing Details of CP 90375-E and CP 90560-E



CYLINDER TYPE (lb)	"A"
375 lb Cylinder	24"
560 lb Cylinder	30"

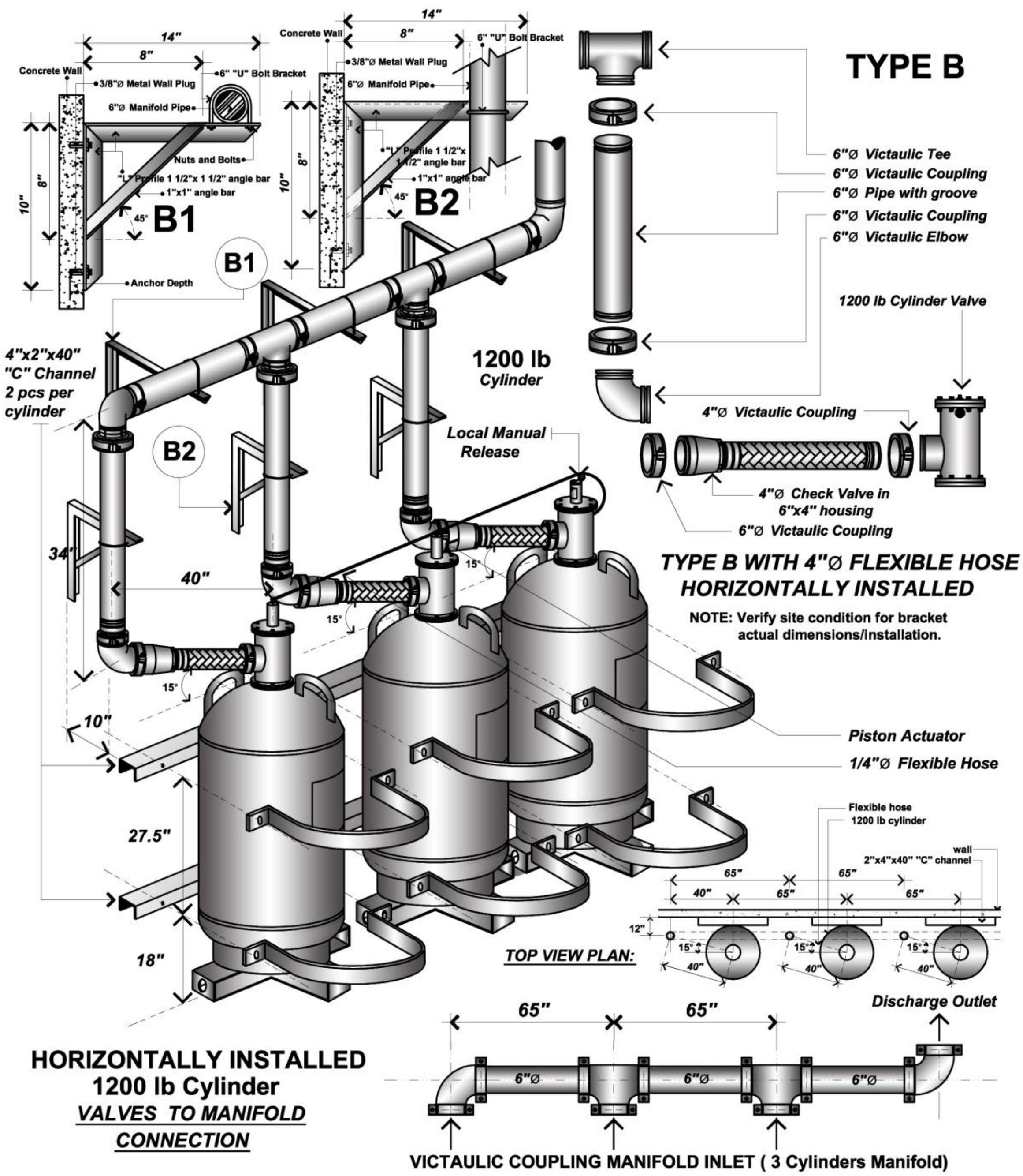
P/N: CP 202502

Figure 56: Vertical Arrangement with Flexible Hose Manifold and Bracketing Details of CP 91200-E



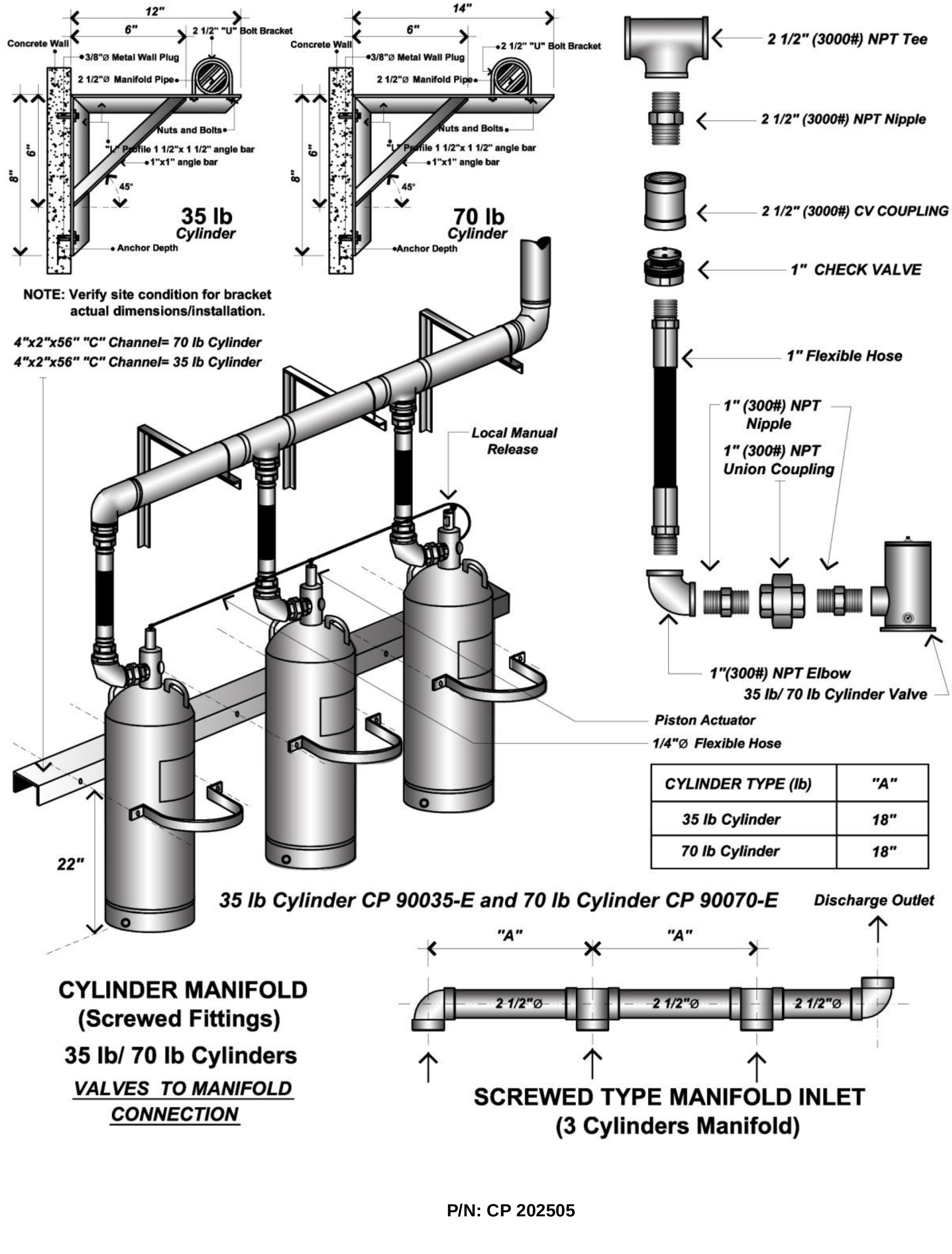
P/N: CP 202503

Figure 57: Horizontal Arrangement with Flexible Hose Manifold and Bracketing Details of CP 91200-E



P/N: CP 202504

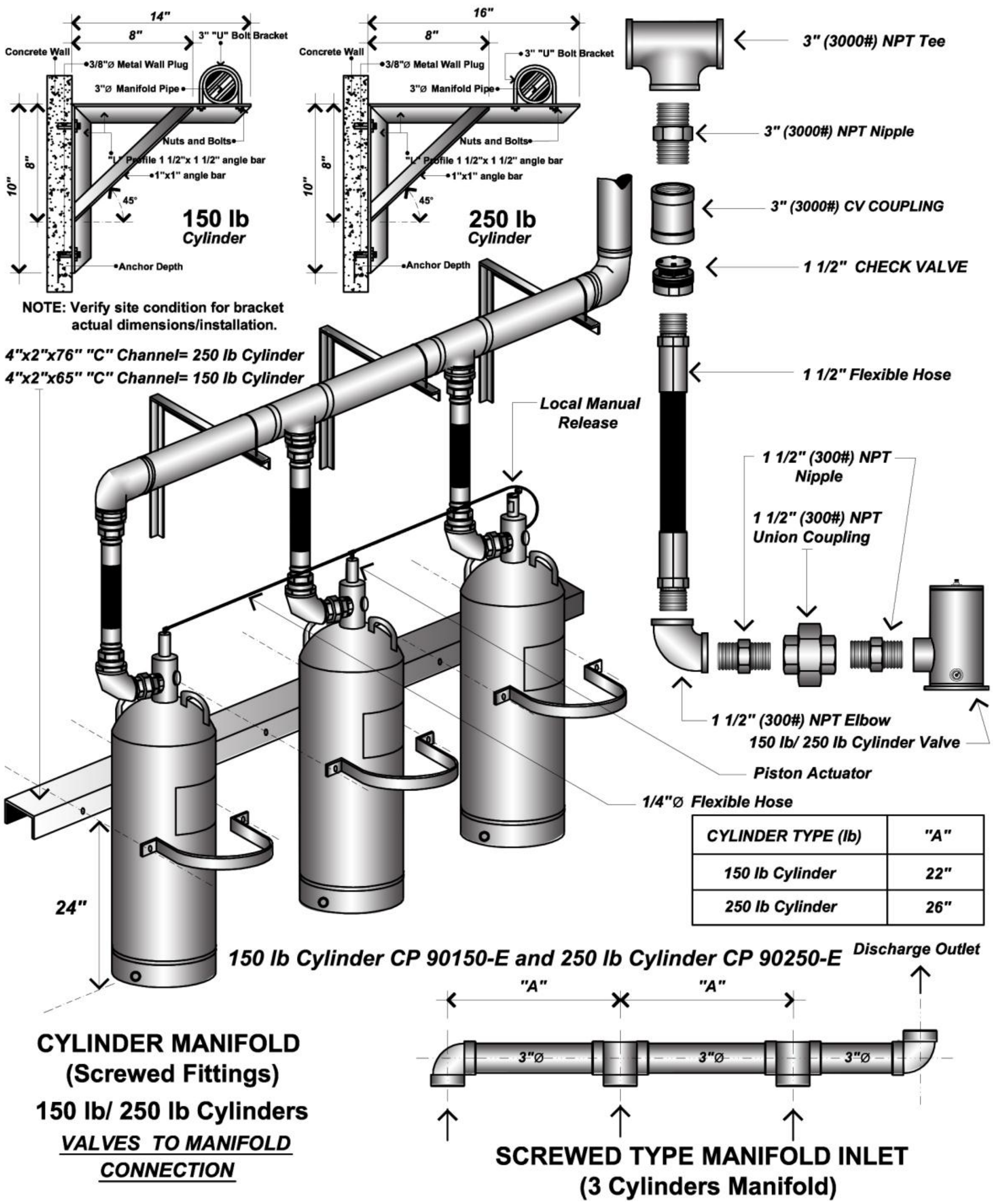
Figure 58: Screwed Type with Flexible Hose Manifold and Bracketing Details of CP 90035-E and CP 90070-E



CYLINDER TYPE (lb)	"A"
35 lb Cylinder	18"
70 lb Cylinder	18"

P/N: CP 202505

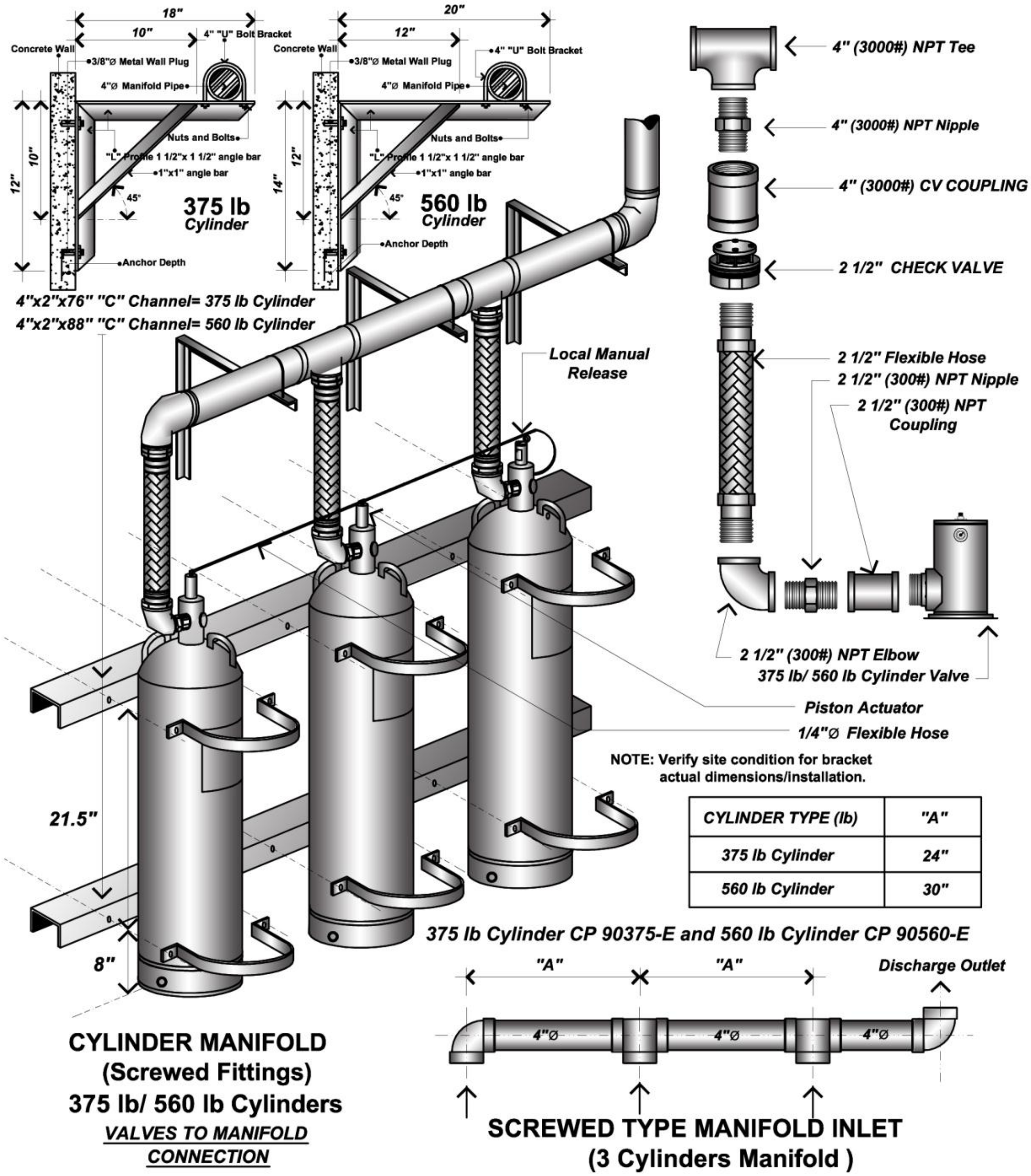
Figure 59: Screwed Type with Flexible Hose Manifold and Bracketing Details of CP 90150-E and CP 90250-E



CYLINDER TYPE (lb)	"A"
150 lb Cylinder	22"
250 lb Cylinder	26"

P/N: CP 202506

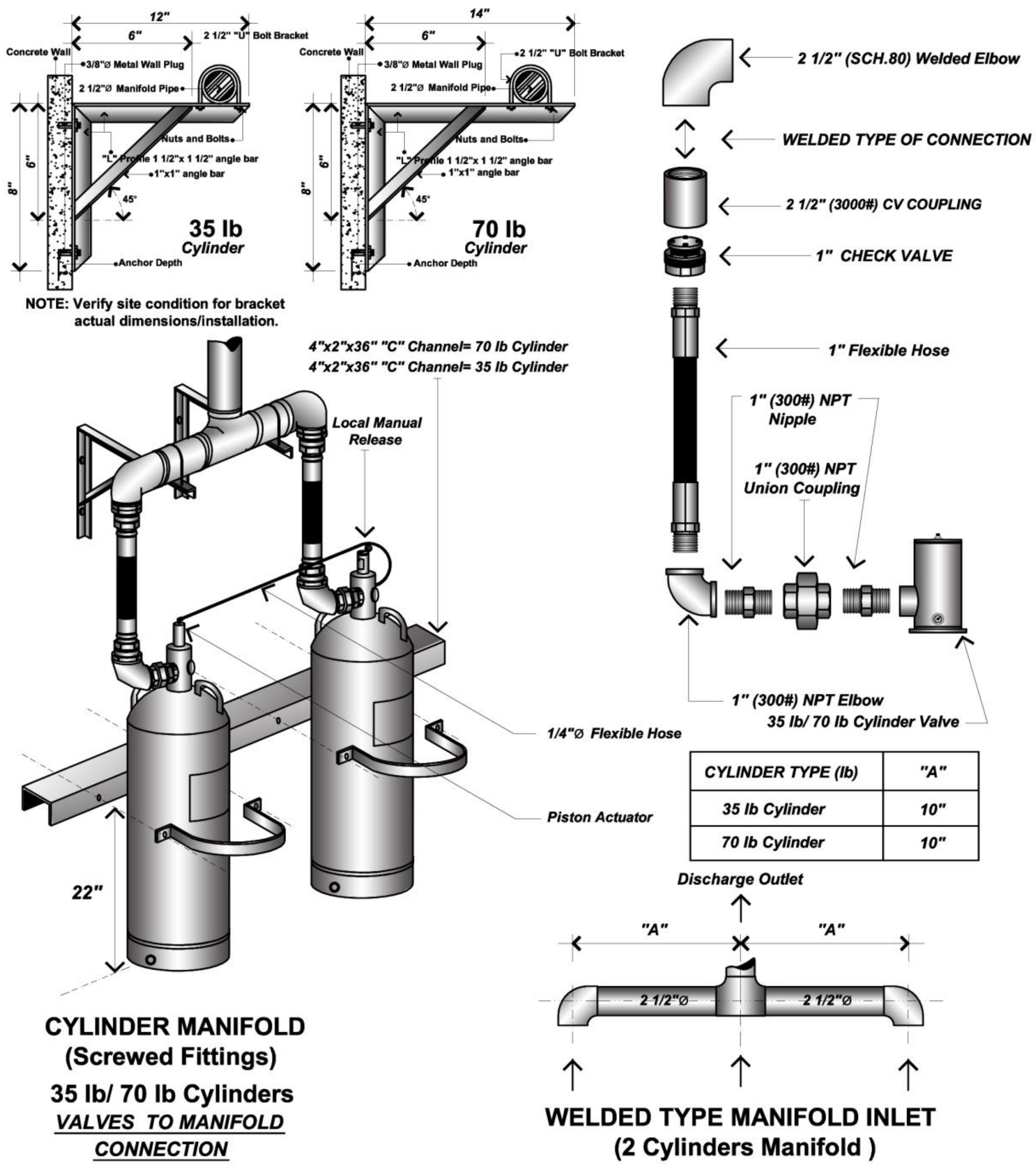
Figure 60: Screwed Type with Flexible Hose Manifold and Bracketing Details of CP 90375-E and CP 90560-E



CYLINDER TYPE (lb)	"A"
375 lb Cylinder	24"
560 lb Cylinder	30"

P/N: CP 202507

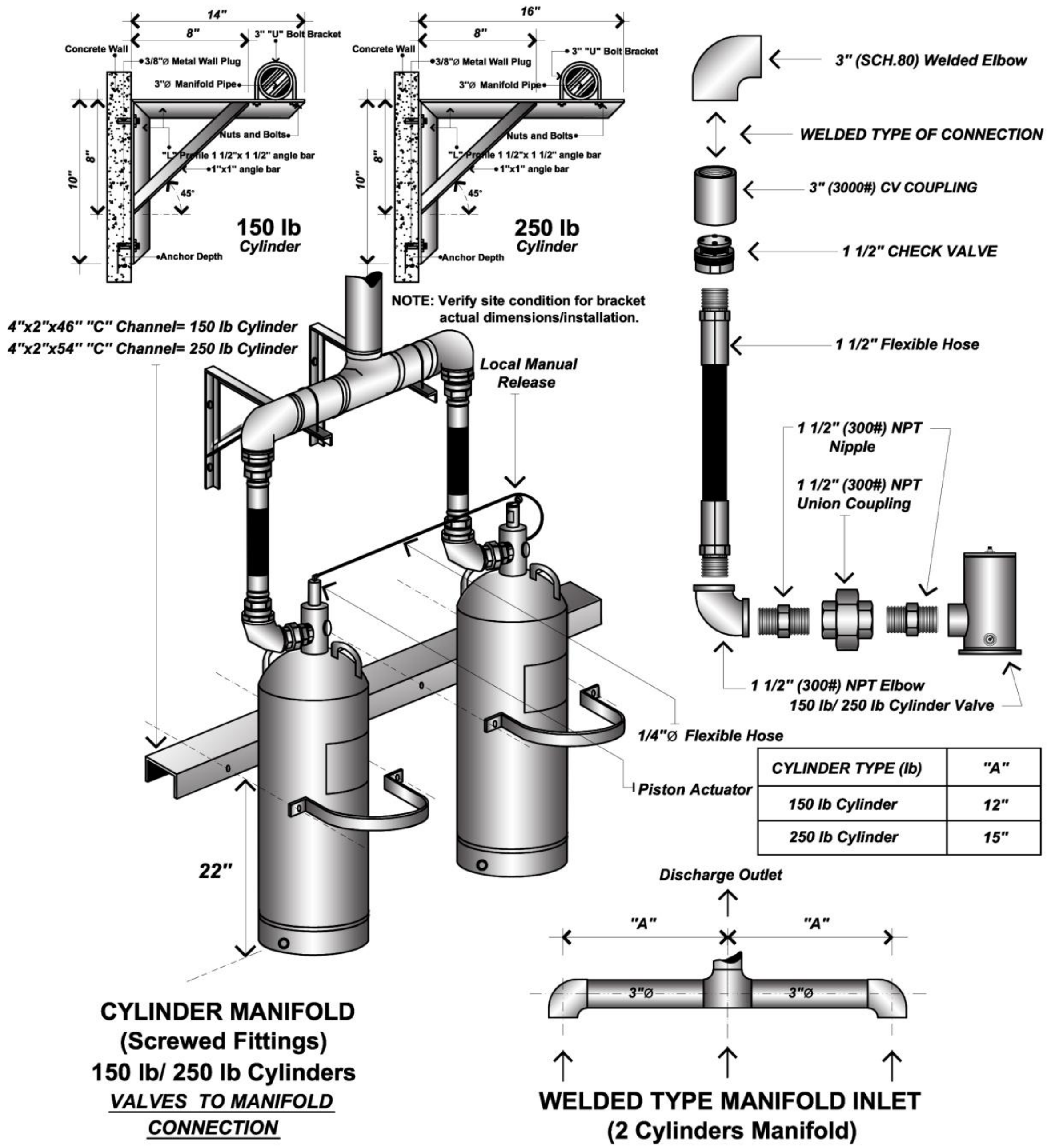
Figure 61: Welded Type with Flexible Hose Manifold and Bracketing Details of CP 90035-E and CP 90070-E



CYLINDER TYPE (lb)	"A"
35 lb Cylinder	10"
70 lb Cylinder	10"

P/N: CP 202508

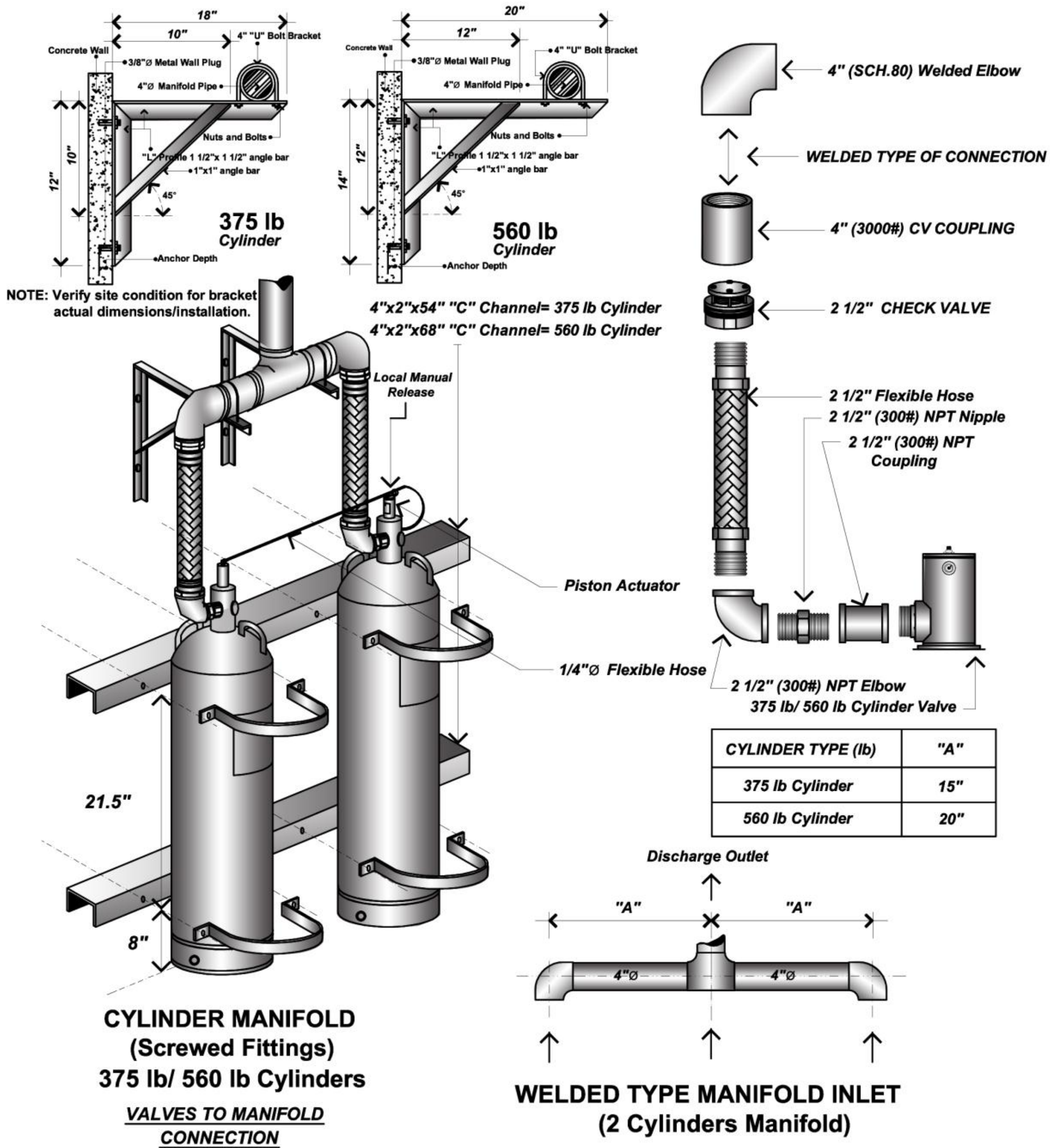
Figure 62: Welded Type with Flexible Hose Manifold and Bracketing Details of CP 90150-E and CP 90250-E



CYLINDER TYPE (lb)	"A"
150 lb Cylinder	12"
250 lb Cylinder	15"

P/N: CP 202509

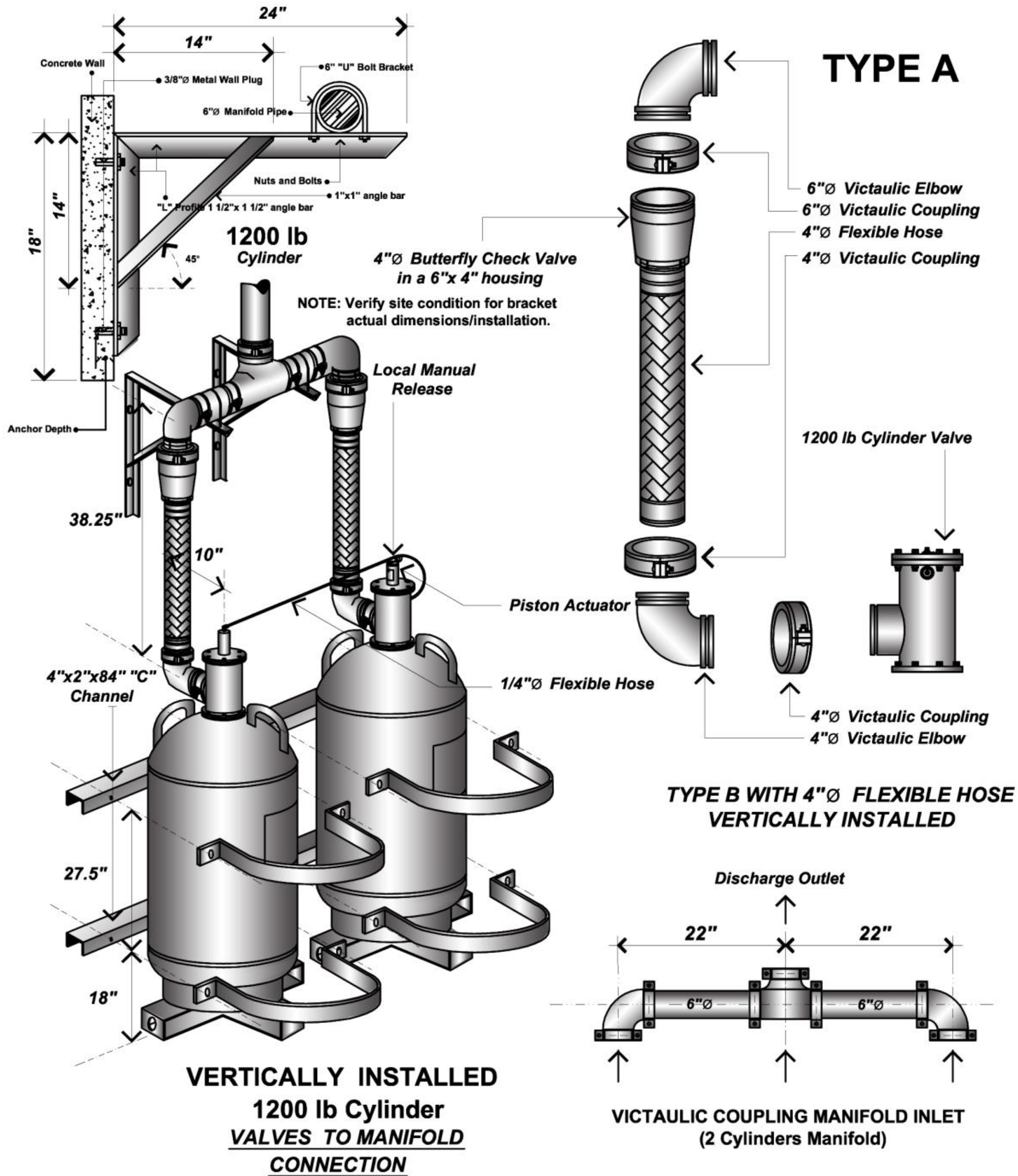
Figure 63: Welded Type with Flexible Hose Manifold and Bracketing Details of CP 90375-E and CP 90560-E



CYLINDER TYPE (lb)	"A"
375 lb Cylinder	15"
560 lb Cylinder	20"

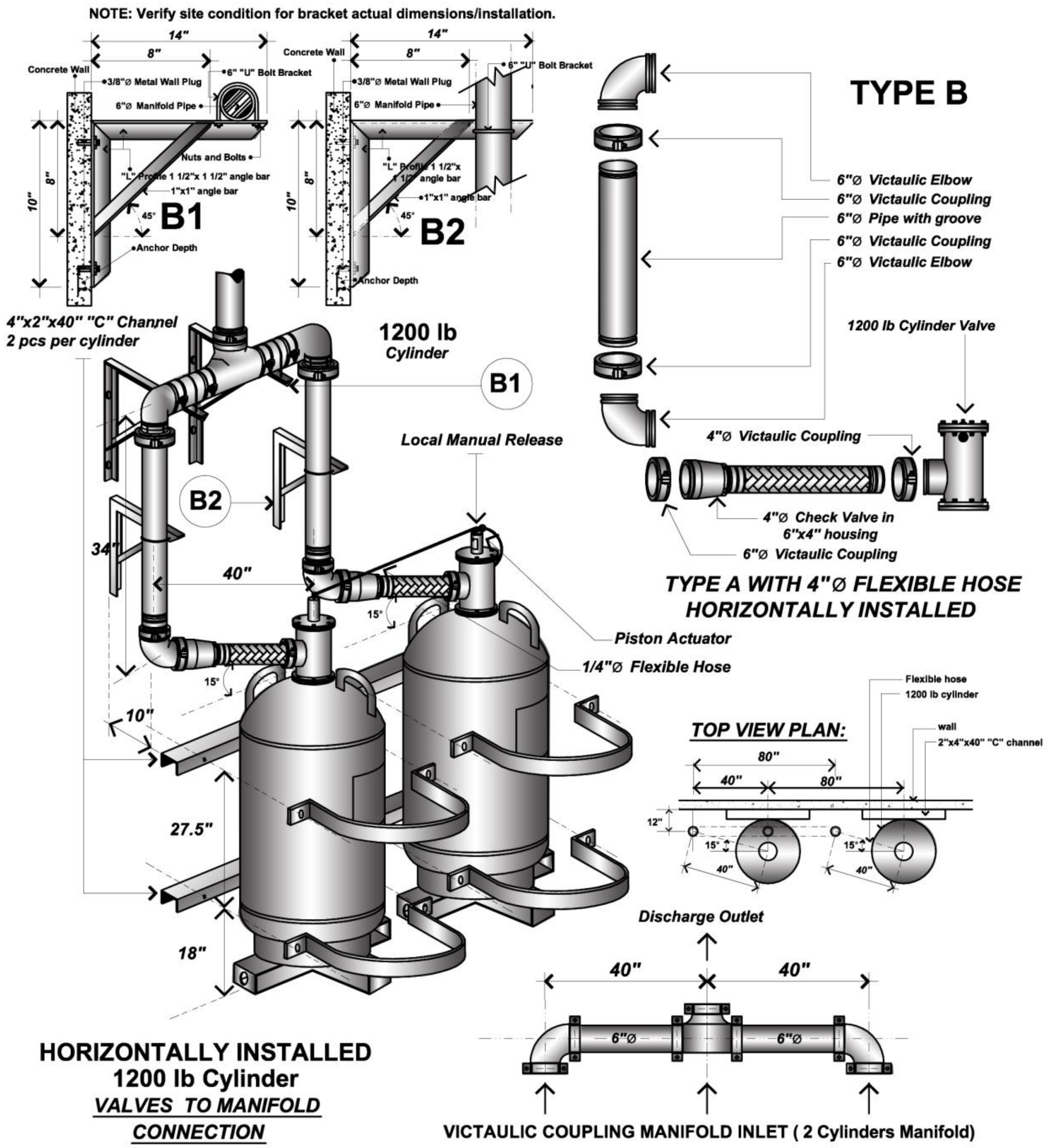
P/N: CP 202510

Figure 64: Vertical Arrangement with Flexible Hose Manifold and Bracketing Details of CP 91200-E



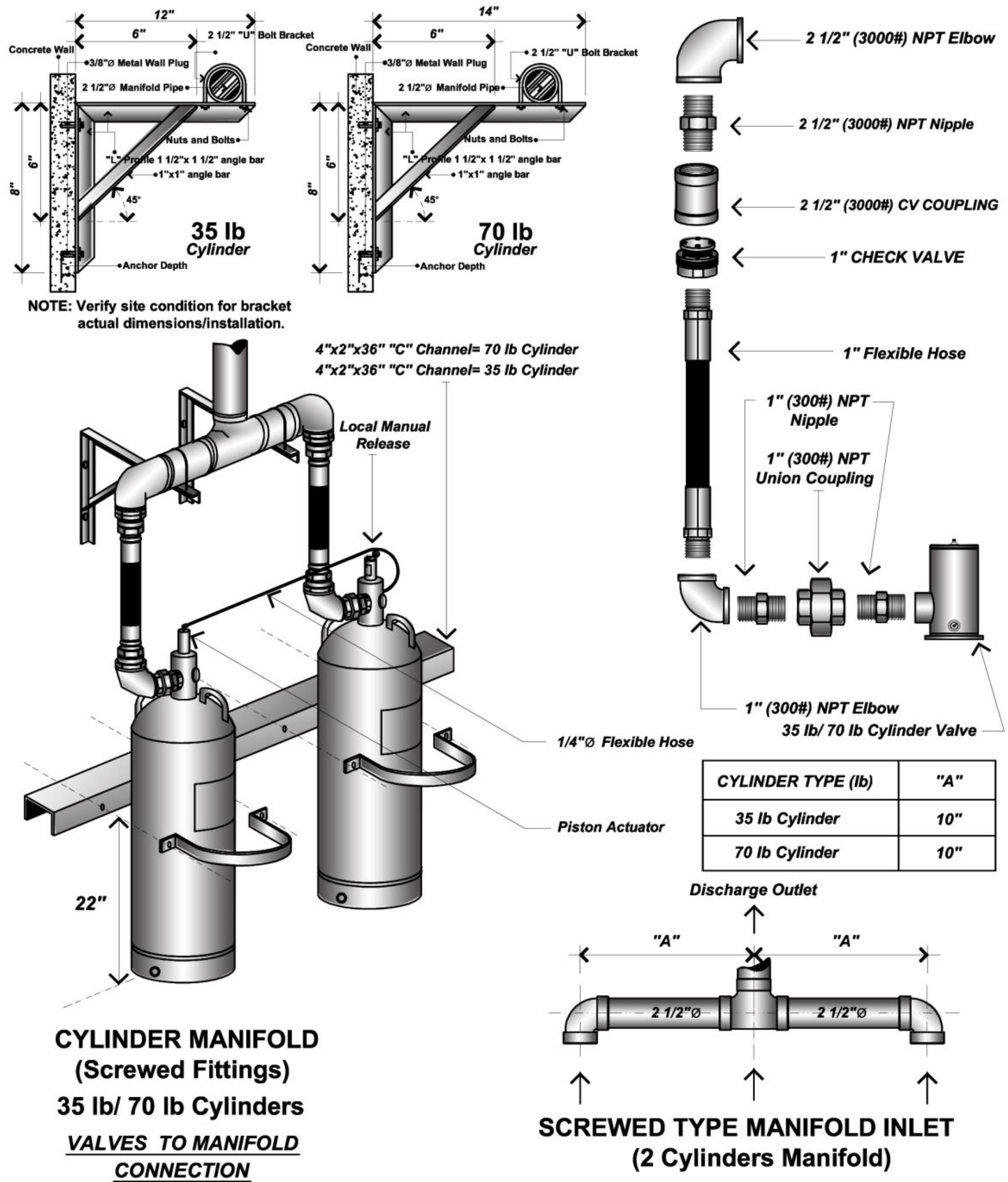
P/N: CP 202511

Figure 65: Horizontal Arrangement with Flexible Hose Manifold and Bracketing Details of CP 91200-E



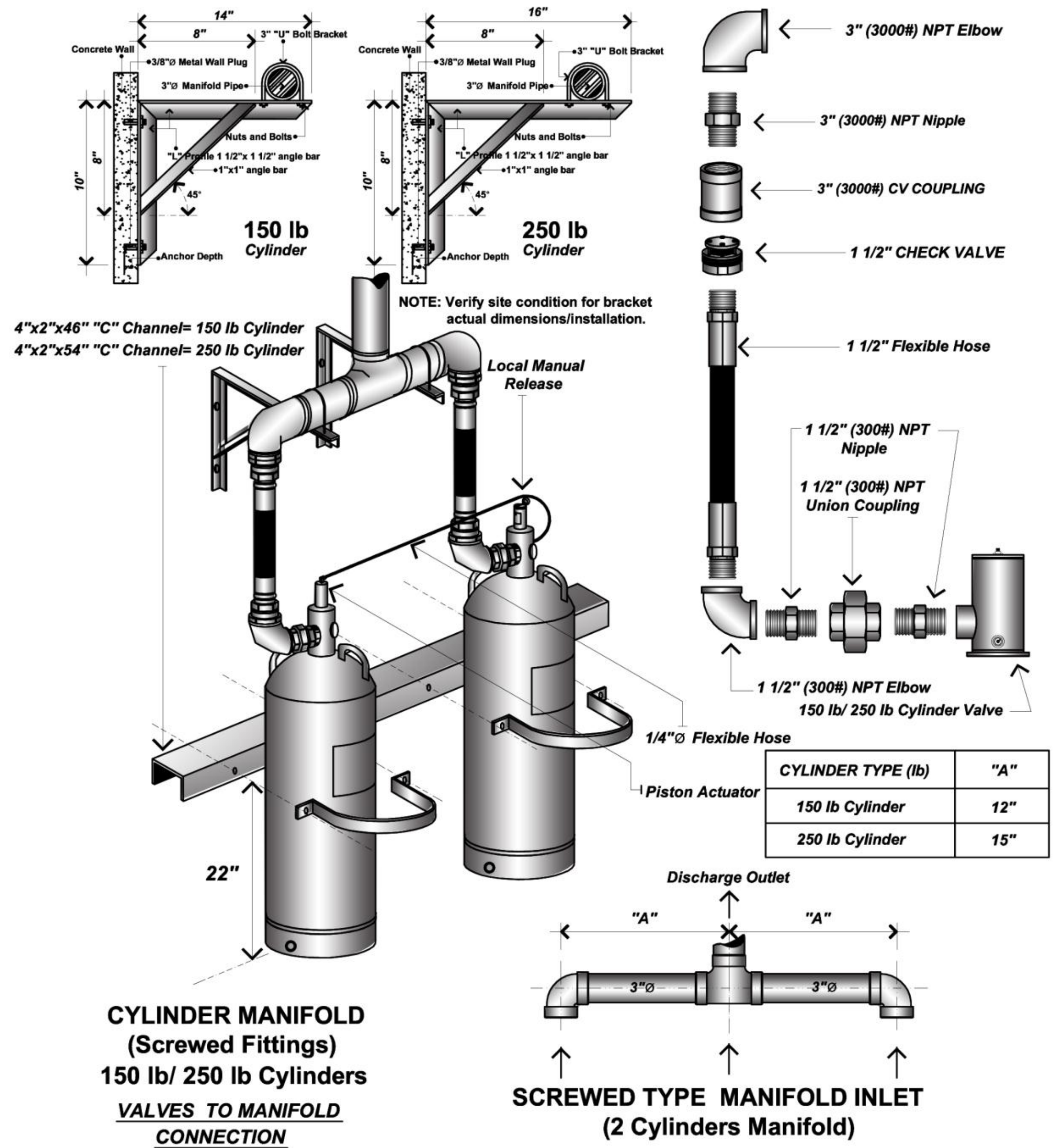
P/N: CP 202512

Figure 66: Screwed Type with Flexible Hose Manifold and Bracketing Details of CP 90035-E and CP 90070-E



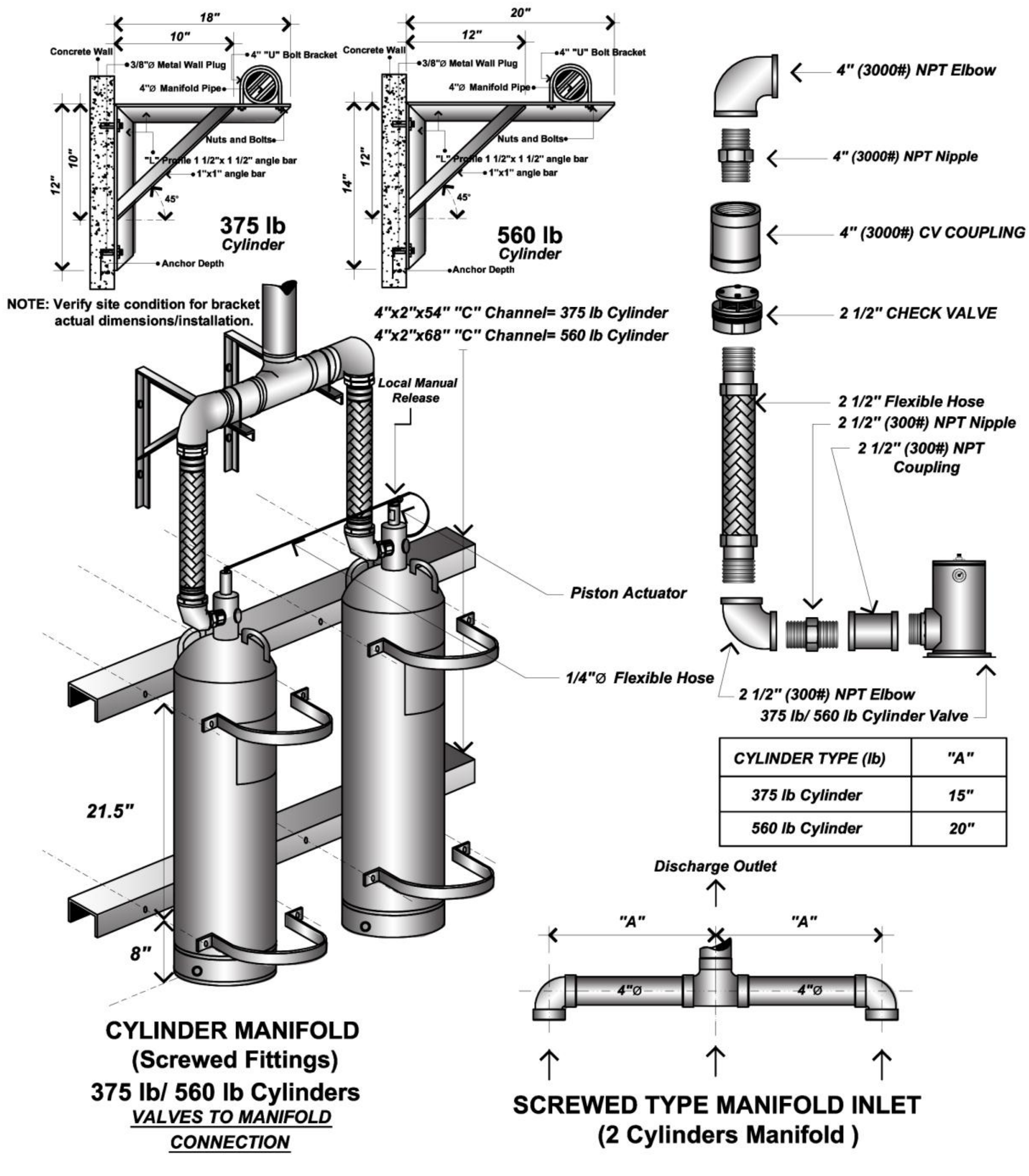
P/N: CP 202513

Figure 67: Screwed Type with Flexible Hose Manifold and Bracketing Details of CP 90150-E and CP 90250-E



P/N: CP 202514

Figure 68: Screwed Type with Flexible Hose Manifold and Bracketing Details of CP 90375-E and CP 90560-E



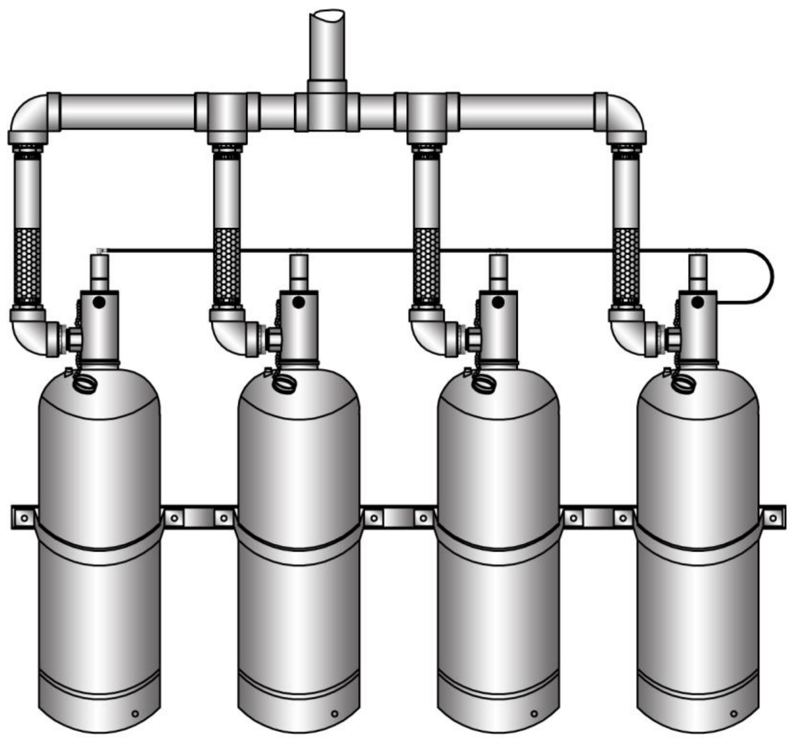
CYLINDER TYPE (lb)	"A"
375 lb Cylinder	15"
560 lb Cylinder	20"

P/N: CP 202515

NOTE:

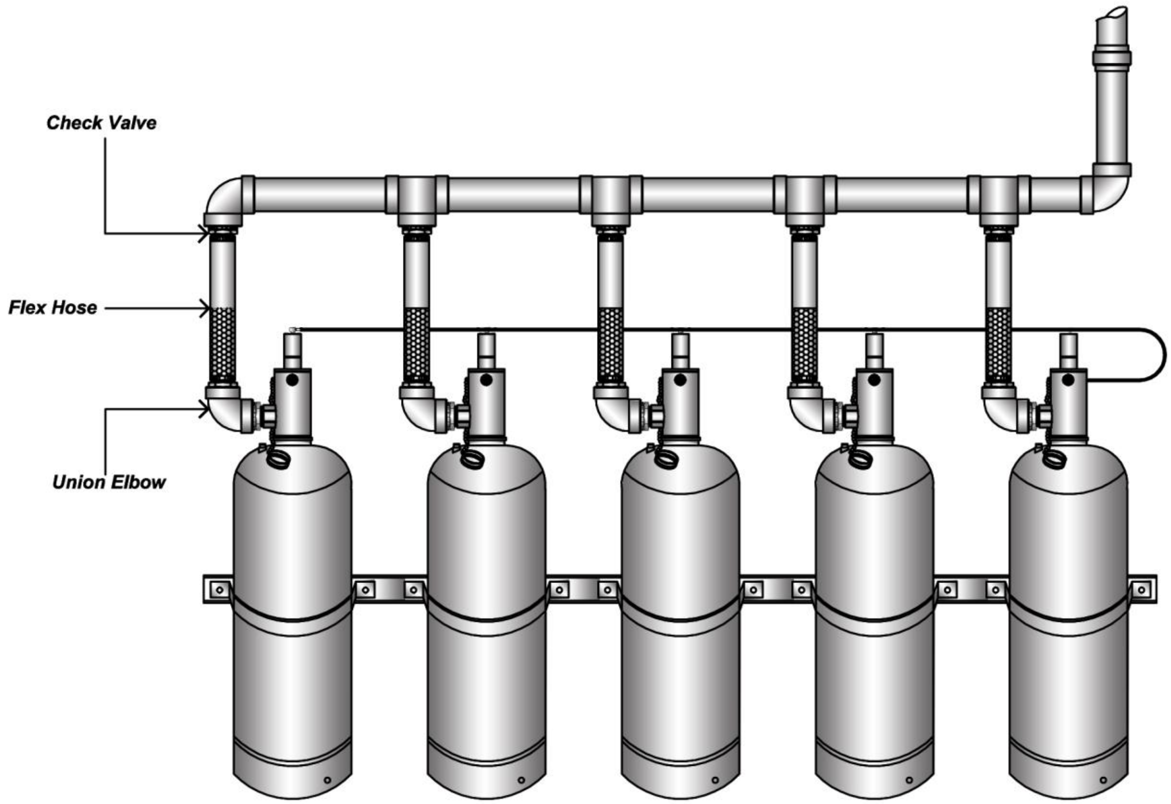
1) **When designing systems with a manifold, all of the cylinders must be the same size and fill density.**
2) **A center outlet manifold will be the most economical option. It can be used when an even number of cylinders are manifolded together. If the hazard requires an odd number of cylinders, an end outlet type of manifold is to be used. See Figure 66 and 67 for details.**

Figure 69: Typical Center Outlet Manifold



NOTE: The 2 ½ inch check valve can only be installed vertically.

Figure 70: Typical End Outlet Manifold





NOTE: The 2 ½ inch check valve can only be installed vertically.

3.6 Flow Limitations

The HFC-227ea Flow Calculation Software CP 3.10 will select the pipe sizes for each section in the piping network based on the HFC-227ea flow rate for each section. Otherwise, pipe sizes can be manually input into the program. When doing so, the selected pipe sizes must fall within a minimum and a maximum range of flow rates as shown in Table 16.

Table 17: Minimum and Maximum Range of Flow Rates

Nominal Pipe Size	Minimum and Maximum Flow Rates (lb/sec)
1/2" - SCH 40	0.7 – 3.4
3/4" - SCH 40	2.0 – 5.8
1" - SCH 40	3.4 – 8.4
1-1/4" - SCH 40	5.8 – 13.0
1-1/2" - SCH 40	8.4 – 19.5
2" - SCH 40	13.0 – 33.0
2-1/2" - SCH 40	19.5 – 58.0
3" - SCH 40	33.0 – 95.0
4" - SCH 40	58.0 – 127.0
5" - SCH 40	95.0 – 222.0
6" - SCH 40	127.0 – 317.8

NOTE:

1) **Table 16 assumes the use of a grade of pipe, which may be used in Schedule 40 wall thickness in the full range of pipe sizes noted.**
2) **Table 16 gives approximate sizes only. The fact that a system may be estimated by this table does not guarantee that sufficient pressure is available to actually develop an acceptable piping network. Long runs of pipe or large numbers of fittings may drop the system pressures below acceptable limits even when pipe sizes fully conform to the table. An actual computer calculation must be done to confirm both pipe sizes and the feasibility of the piping network.**

Table 18: Flow Limitations

1. Duration of discharge:	The liquid HFC-227ea discharge from a nozzle shall not exceed 10 seconds in accordance to the NFPA 2001. A design discharge time of less than 6 seconds liquid is not to be used.
2. Maximum percentage in pipe:	82.1 %
3. Minimum orifice area:	The minimum orifice area ratio for 1/2" nozzles is 10 % of open end pipe. For the remainder of nozzle sizes, the ratio is 20% of open end pipe.
4. Limit of agent:	Limit of agent before the first tee is 9.3%. The amount of agent in the pipe before the first tee (closest to the agent supply cylinder or cylinders) shall not be less than 9.3 %.
5. Minimum nozzle pressure:	68 psig
6. Maximum nozzle orifice area:	81.3% of open end pipe
7. Minimum flow rates:	The minimum flow rates must be exceeded.
8. Maximum arrival time imbalance:	When the difference between liquid arrival times at two of the nozzles exceeds the 1.02 seconds (max.), a warning will be activated.
9. Maximum run out time imbalance:	The difference between liquid run out times at two of the nozzles exceeds the 2.16 seconds, a warning will be activated.

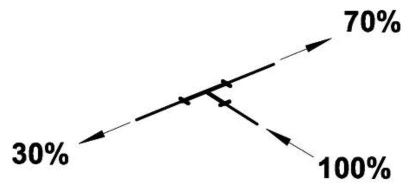
3.7 Tee Limitations

To obtain the most economical piping for a given hazard layout, tees are employed to branch the HFC-227ea flow to the various locations within the hazard or multiple hazards. The exit branches of the tees must be horizontal. The maximum and minimum percentage imbalances permitted are shown as follows. The system has been tested using Schedule 40 steel pipe and 300 lb. Class ASTM A-197 fittings. See the User's Manual of HFC-227ea Flow Calculation Software CP 3.10 for more details.

- System maximum imbalance from a branch of a Bullhead Tee is 30 - 70 %.
- System minimum imbalance from a branch of a Bullhead Tee is 50 - 50 %.
- System minimum flow imbalance from the side outlet of a Thru Tee is 10 %.
- System maximum flow imbalance from the side outlet of a Thru Tee is 35%.
- Bullhead tees must have both outlets in the same horizontal plane.
- Side tee splits must have the inlet and both outlets in the same horizontal plane.
- Elbows before tee splits must be located at a minimum distance of 10 nominal pipe diameters upstream of the tee. The fittings are measured center to center.

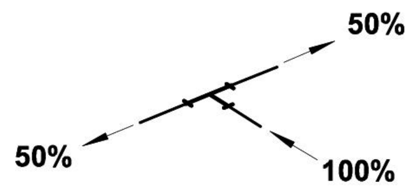
- It is not allowed to increase pipe size/diameter in the downstream flow direction in a piping network.
- Tee splits must be spaced a minimum of 10 nominal pipe diameters apart, plus fittings, measured center to center.

Figure 71: Tee Limitations

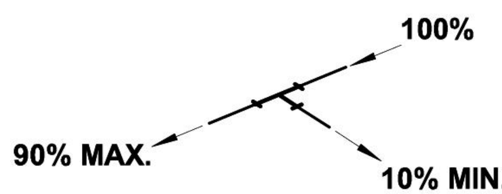


Maximum Imbalance for Bull Tee
Unbalance Limits for Bull Tee

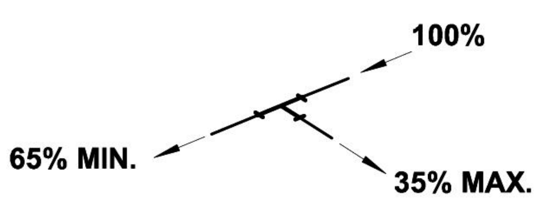
Minimum Imbalance for Bull Tee
Balance for Bull Tee



Minimum Imbalance for Thru Tee Side Outlet Section
Unbalance Limit for Thru Tee allowable for Side Outlet tee

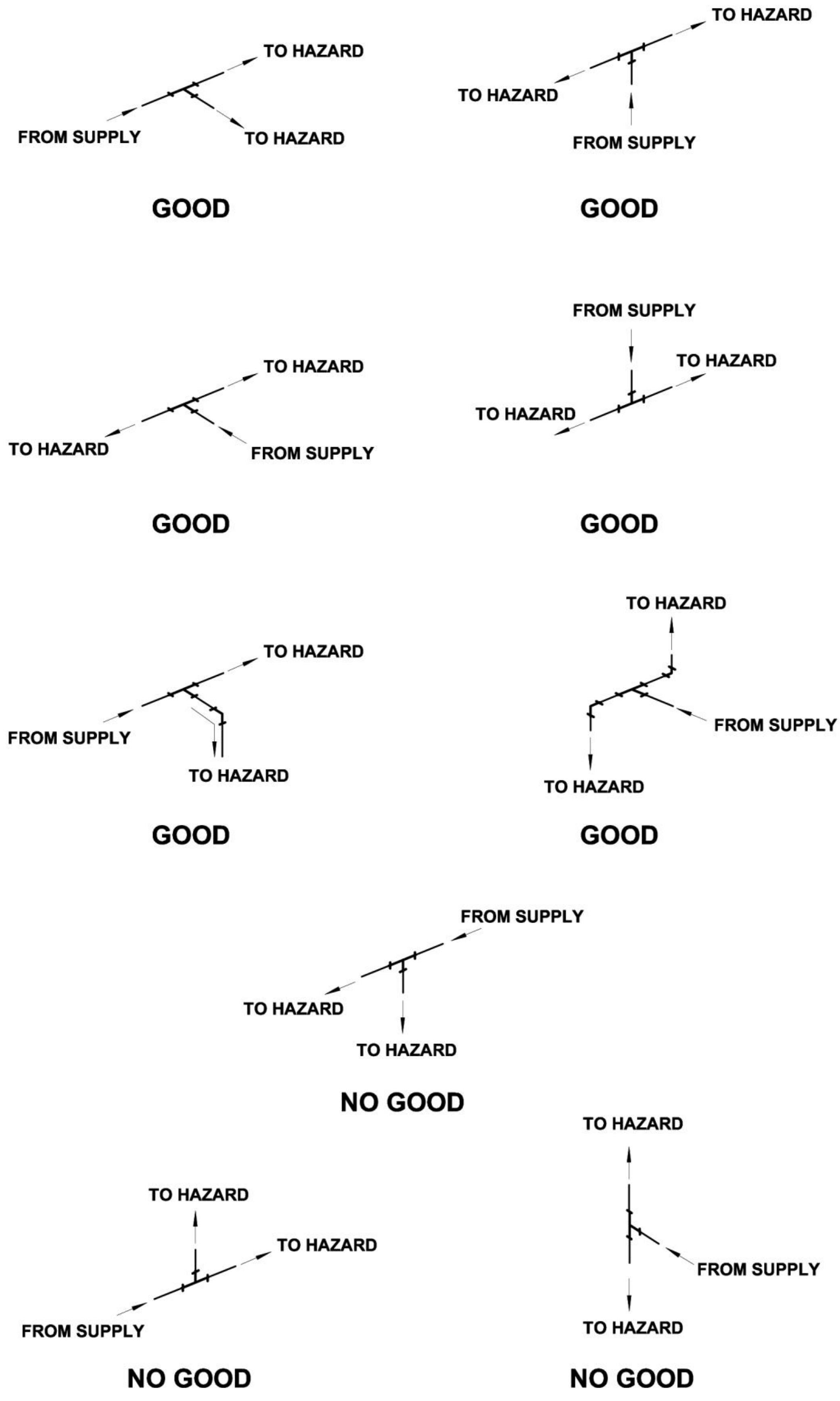


Unbalance Limit for Thru Tee allowable for Side Outlet tee



Maximum Imbalance for Thru Tee Side Outlet Section

Figure 72: Tee Orientations



3.8 Nozzles

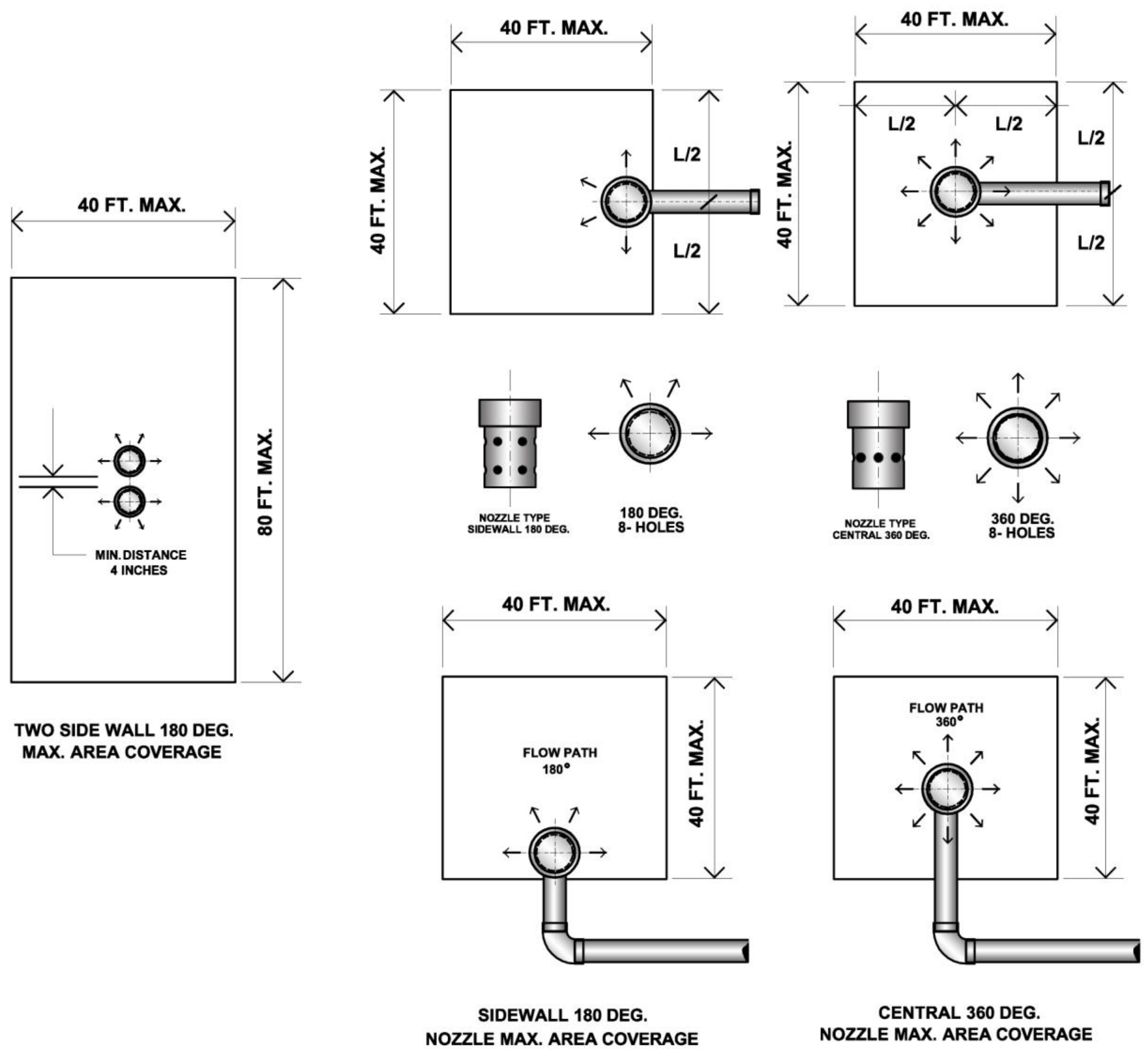
3.8.1 Area Coverage

Nozzles shall be installed with the inlet of the nozzle perpendicular to the ceiling. When installing the 180° sidewall nozzle, the side holes of the pattern are to be parallel with the wall on which the nozzle is being installed. See Figure 70 and 71 for details.

All nozzles are rated for a maximum hazard height of 16 ft (Figure 72). If hazard exceeds 16 ft in height, multiple tiers of nozzles must be used for each 16 ft increment of the height of enclosure.

The maximum area coverage per nozzle is 1600 ft^2 (40 ft x 40 ft). The longest side length is 40 ft (maximum) (see Figure 73). This maximum length limitation applies for a range in hazard height from 1 ft (minimum) to 16 ft (maximum).

Figure 73: Area Coverage per Nozzle



3.8.2 Application

The 180° sidewall nozzle shall be adjacent to a wall. The area coverage cannot be exceeded. Two 180˚ sidewall nozzles may be used at the center of the hazard. They may be applied back to back, providing area coverage of 3200 ft^2 (40 ft x 80 ft). See Figure 70 for details.

The 180° sidewall nozzle may be installed from 2” to 12” down when referenced from the ceiling. When referencing the wall to the nozzle, the range of installation is from 0 to 12” off the wall. For the 180˚ sidewall nozzle reference, the centerline is between the top orifice and the bottom orifice. See Figure 71 for details.

The 360° central nozzle shall be installed at the center of the hazard. The area coverage cannot be exceeded. The nozzle may be installed from 2”to 12” down when referenced from the ceiling. See Figure 71 for details.

During nozzle installation, pipe supports shall be rated to support the dead weight of the piping and the thrust forces of the HFC-227ea discharge.

Figure 74: Nozzle Location within a Hazard

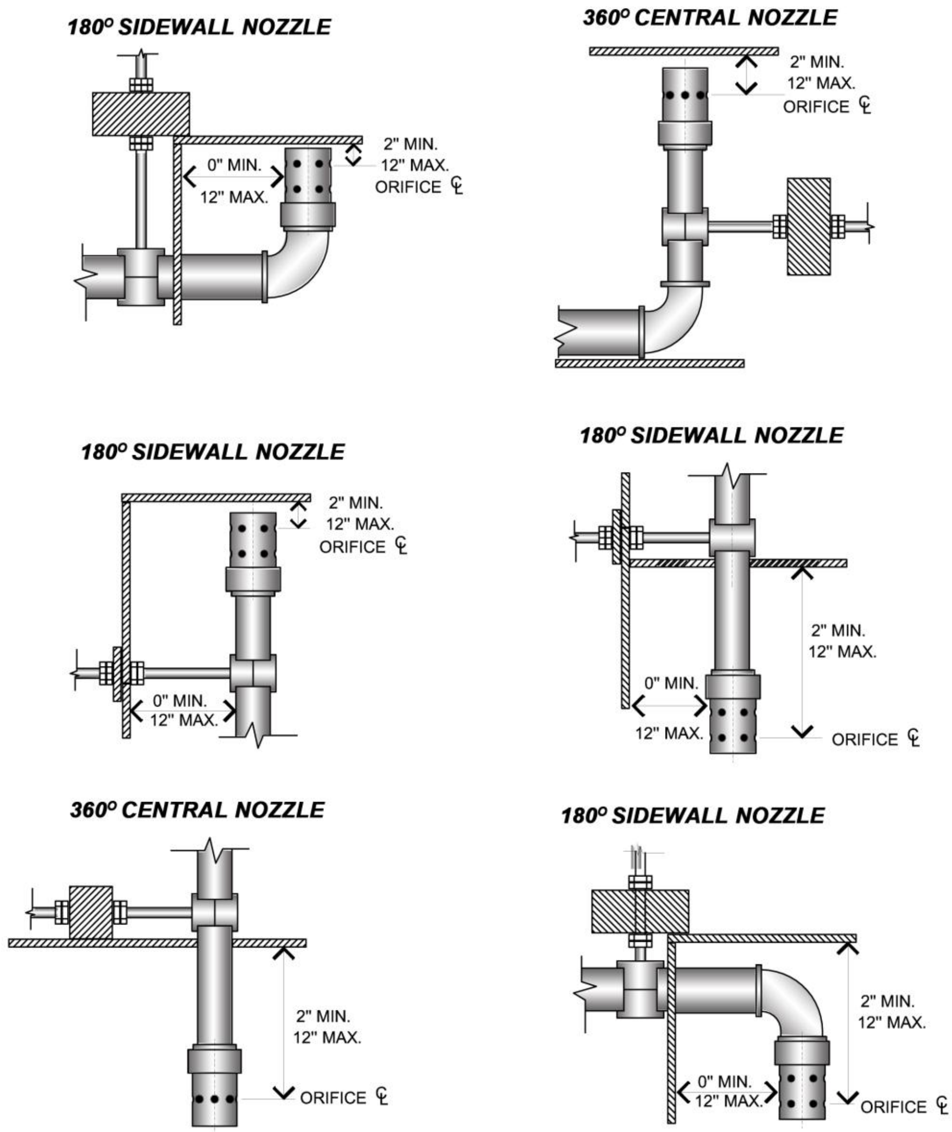
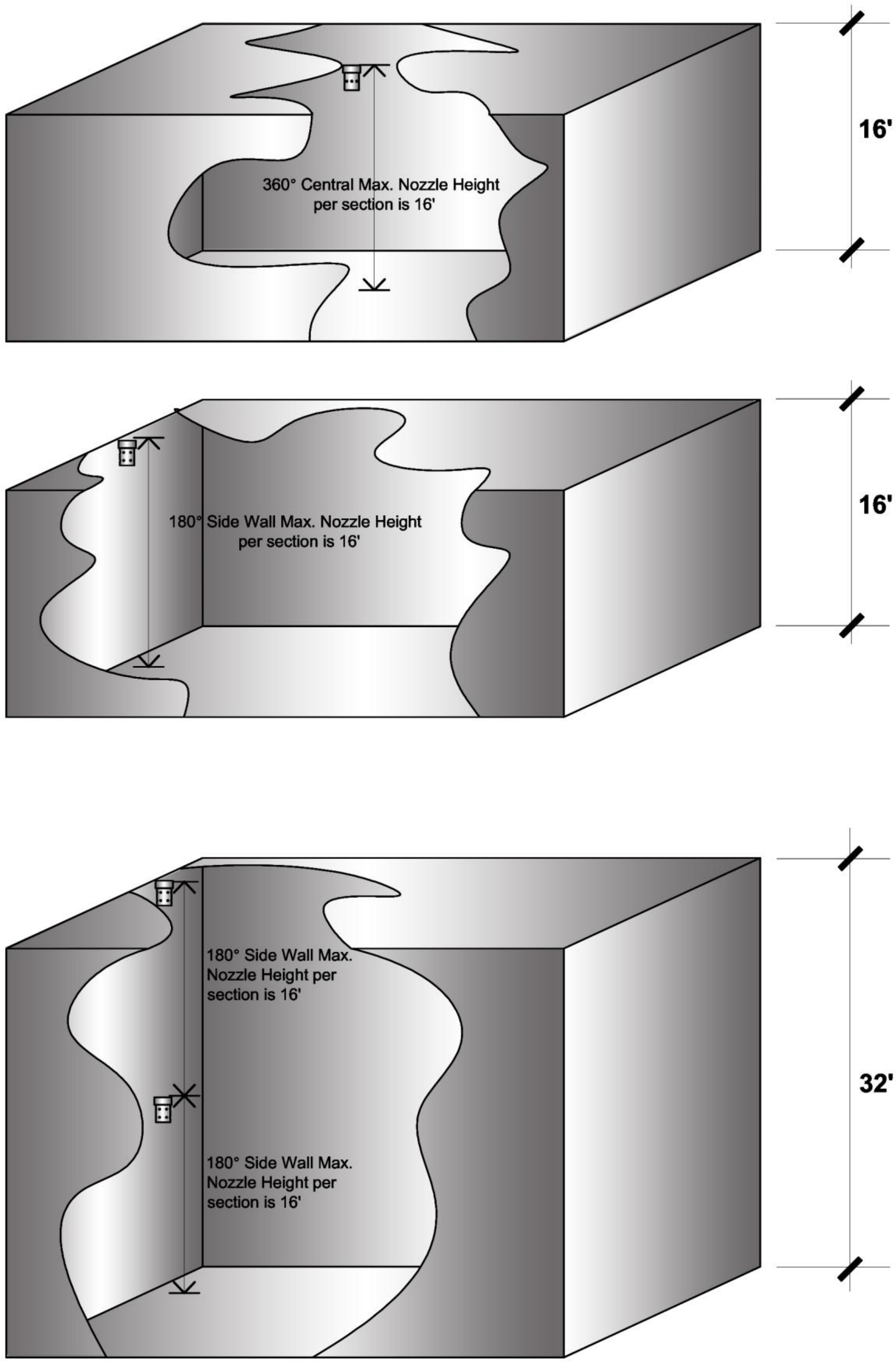


Figure 75: Nozzle Elevation



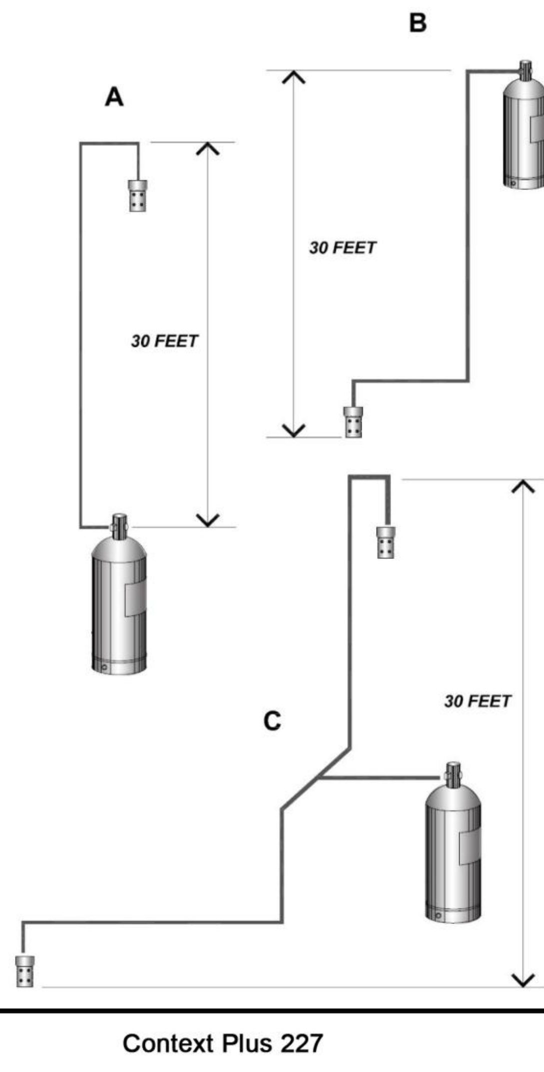
CAUTIONS:

1. **If nozzles are only located above the cylinder outlet, the maximum elevation difference between the cylinder outlet and the farthest horizontal pipe run or discharge nozzle (whichever is furthest) shall not exceed 30 ft.**
2. **If nozzles are only located below the cylinder outlet, the maximum elevation difference between the cylinder outlet and the farthest horizontal pipe run or discharge nozzle (whichever is furthest) shall not exceed 30 ft.**
3. **If nozzles are located above and below the cylinder outlet, the maximum elevation difference between the farthest horizontal pipe runs or nozzles (whichever is furthest) shall not exceed 30 ft.**

NOTE:

1) **If a system violates these limits, then consult the manufacturer engineering team for design review, and what course of action should be taken.**
2) **Remember to review the cylinder location, the anticipated piping requirements, and any obstructions that will hinder the distribution of the agent.**

Figure 76: Maximum Allowable Distance from the Cylinder Outlet



3.9 Unbalanced Systems

For unbalanced systems, one or more of the following conditions apply:

a) Unequal flow rates at one or more nozzles.
b) Unequal orifice areas in multiple nozzle systems.
c) Unequal pipe sizes and/or lengths of branch legs.
d) Odd number of nozzles.
e) Both Bull tees and Side/Thru tee applications are used. The tee exits must be in the horizontal plane.

CAUTION: Calculation is based on agent storage temperature of 70°F. Therefore, the operating/storage temperature of the container must be in the 60°F to 80°F range for a single unbalanced system protecting two or more separate hazards. If the container operating/storage temperature is outside this range, an insufficient quantity of agent may be discharged from one or more discharge nozzles.

3.10 Equivalent Length Data

Table 19: Equivalent Length (in ft) of 300 lb Malleable Threaded Fittings

Pipe Size	90 Elbow	45 Elbow	Thru Tee	Side Tee	Union Coupling	Union Elbow
1/2”	1.7	0.8	1.0	3.4	0.4	2.1
3/4”	2.2	1.0	1.4	4.5	0.5	2.7
1”	2.8	1.3	1.8	5.7	0.6	3.4
1-1/4”	3.7	1.7	2.3	7.5	0.9	5.2
1-1/2”	4.3	2.0	2.7	8.7	0.9	5.2
2”	5.5	2.6	3.5	11.2	1.2	6.7
2-1/2”	6.5	3.1	4.1	13.4	1.4	8.0
3”	8.2	3.8	5.1	16.8	1.8	10.0
4”	10.7	5.0	6.7	21.8	2.4	13.1
5”	13.4	6.3	8.4	27.4	3.0	16.4
6”	16.2	7.6	10.1	32.8	3.5	19.7

Table 20: Equivalent Length (in ft) of Victaulic Fittings

Pipe Size	90 Elbow	45 Elbow	Thru Tee	Side Tee
3/4”	1.3	0.6	1.3	3.2
1”	1.7	0.8	1.7	4.2
1-1/4”	2.1	1.0	2.1	5.3
1-1/2”	2.6	1.2	2.6	6.3
2”	3.5	1.8	3.5	8.5
2-1/2”	4.3	2.2	4.3	10.8
3”	5.0	2.6	5.0	13.0
4”	6.8	3.4	6.8	16.0
5”	8.5	4.2	8.5	21.0
6”	10.0	5.0	10.0	25.0

Table 21: Equivalent Length (ft) of Welded Fittings

Pipe Size	90 Elbow	45 Elbow	Thru Tee	Side Tee
1/2”	0.8	0.3	0.7	2.1
3/4”	1.1	0.4	0.9	2.8
1”	1.4	0.5	1.1	3.5
1-1/4”	1.8	0.7	1.5	4.6
1-1/2”	2.1	0.8	1.7	5.4
2”	2.8	1.0	2.2	6.9
2-1/2”	3.3	1.2	2.7	8.2
3”	4.1	1.5	3.3	10.2
4”	5.4	2.0	4.4	13.4
5”	6.7	2.5	5.5	16.8
6”	8.1	3.0	6.6	20.2

Table 22: Equivalent Length (in ft) of Tubing, Hoses, and Valves

Valve Size	Valve and Siphon	Discharge Flex Hose	Check Valve	Shuttle Check Valve
1”	16.5	7.0	6.9	8.1
1”	17.5	7.0	6.9	8.1
1-1/2”	28.3	7.6	39.5	12.3
1-1/2”	28.3	7.6	39.5	12.3
2-1/2”	30.8	11.6	22.0	N/A
2-1/2”	30.8	11.6	22.0	N/A
		Flex		
4”	75.0	10.0	N/A	
		Flex-Check Combination		
4”	75.0	60.5		

4 Maintenance

4.1 Hardware Checkout after Installation

The following checkout procedure applies to the Context Plus furnished HFC-227ea hardware only. Automatic detection, releasing control panel, the associated devices (alarms, pull stations, etc.) along with their associated control functions are required to be checked in accordance to this manual and the NFPA 2001.

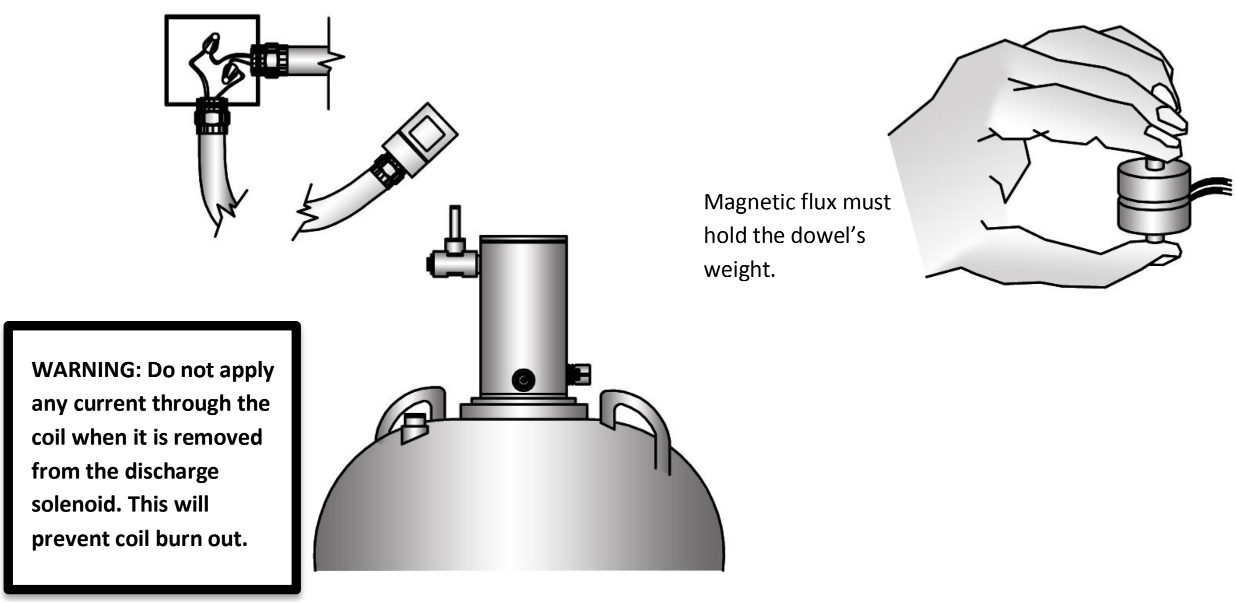
NOTE: All detection devices, auxiliary alarms, and control devices must be electrically compatible with each other. They must be UL Listed by the authorities having jurisdiction. The control panel must be UL Listed for releasing device service and electrically compatible with the Context Plus electrical components.

4.1.1 Electric Solenoid

The Electric Solenoid checkout process consists of the following steps: (see also Figure 77)

1. Disconnect solenoid wiring to control panel.
2. Remove coil from solenoid assembly by removing retaining nut and sliding the coil off of the shaft.
3. Reconnect solenoid wiring to control panel.
4. Insert test dowel (Part Number: CP 50310) into the coil.
5. Energize the coil by cycling the control panel. A magnetic field will be formed by the functioning of the coil and will grasp and hold the test dowel.

Figure 77: Ideal Setup for Electric Solenoid



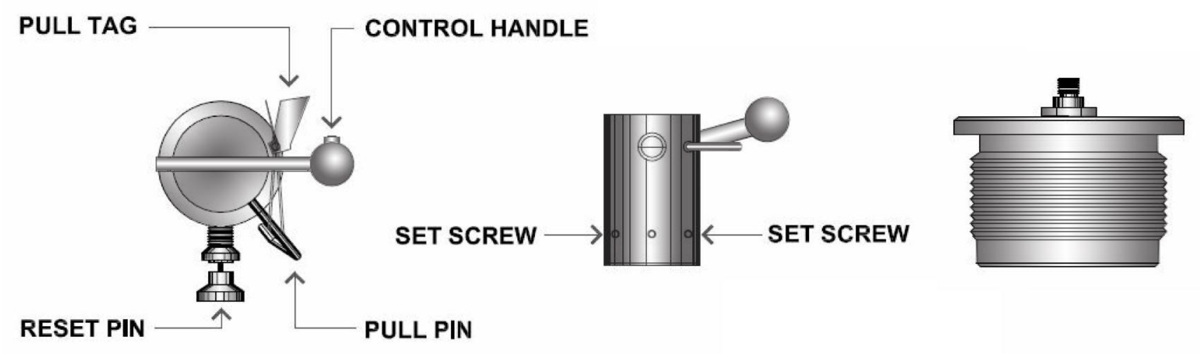
NOTE: Any devices other than Context Plus test dowel (Part Number: CP50310) could result in coil burnout.

4.1.2 Local Manual Control Head

The Local Manual Control Head (Part Number: CP 61033) checkout process consists of the following steps: (see also Figure 78)

1. Remove the Local Manual Control Head from the Top Plug Adapter.
2. Remove pull-pin.
3. Operate lever and observe the lock-pin full travel across the top of the control handle.
4. Reset by pulling out the lock-pin, and at the same time, pulling up on the control handle. Replace the pull-pin and reseal with breakaway plastic seal.
5. Replace Local Manual Control Head onto the Top Plug Adapter.

Figure 78: Ideal Setup for Local Manual Control Head

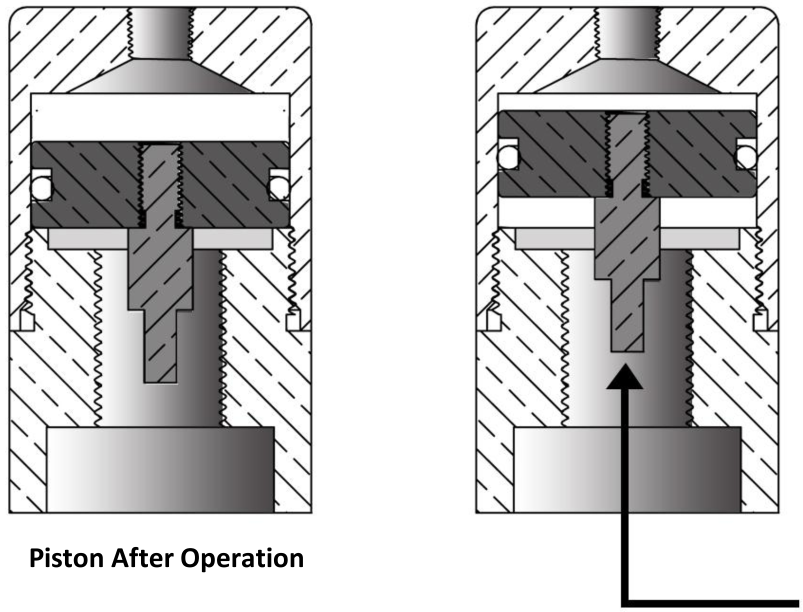


4.1.3 Piston Actuator

The Piston Actuator (Part Number: CP 61041) checkout process consists of the following steps: (see also Figure 79)

1. Detach 1/4" flex hose or 1/4" copper tubing from the top of the Piston Actuator.
2. Remove Piston Actuator from the Top Plug Adapter.
3. Attach a regulated nitrogen source of 20-25 psi to the top of the Piston Actuator.
4. Apply 20-25 psi pressure to the top of the Piston Actuator. The piston rod must travel a full stroke, as seen by the piston going flush with the top of the lower piston body.
5. Relieve pressure to the top of the Piston Actuator. After the test, the piston must be manually pushed to the top of the piston body. Do not return the piston actuator to the Top Plug Adapter without resetting the piston.
6. Once the piston is reset, return the piston actuator to the Top Plug Adapter.
7. Re-assemble 1/4" flex hose or 1/4" copper tubing to the top of the Piston Actuator.

Figure 79: Ideal Setup for Piston Actuator



Piston After Operation

To return Piston after operation, Push Up on the Piston Rod.

CAUTION:

a) **DO NOT APPLY PRESSURE WHILE THE UPPER BODY IS NOT ATTACHED TO THE LOWER BODY. The lower body must be the brake for the piston.**
b) **If you do not reset the piston, the valve will discharge.**

NOTES:

a) **Cylinder brackets are firmly secured in place.**
b) **Cylinder is secured to the brackets.**
c) **Pipe brackets and hangers are firmly secured in place.**
d) **Pipe is secured to brackets and hangers.**
e) **Tees must exit in the horizontal plane.**
f) **Nozzles are at proper location (see Section 53).**
g) **De-energize the coil circuit by resetting control panel.**
h) **Disconnect solenoid wiring from control panel.**
i) **Re-install coil on shaft using retaining clip.**
j) **Reconnect solenoid wiring to control panel.**

4.2 Regular Maintenance

Context Plus systems shall be maintained in accordance to the NFPA 2001 and this manual.

4.2.1 Weekly

The owner or designated personnel are suggested to perform the following checks:

1. Check pressure gauge(s) on cylinder valve(s). If the pressure is 10 % below the pressure required for the temperature of the cylinder at time of inspection, the cylinder must be serviced by an authorized Context Plus distributor. It is recommended that a copy of Table 22 made with all pertinent information filled-in and locates in the vicinity of the cylinder location.
2. Check for physical damage or missing parts from the HFC-227ea system hardware.
3. Check the orientation and tightness of the discharge nozzles.
4. Check for obstructions that would interfere with nozzle discharge pattern or mechanical operation of the system.
5. Check that all tamper seals are still intact and secure.

Table 23: Minimum Pressure at Time of Inspection

Temperature		Nominal Charged Pressure	
°F	°C	psig	bar
32	0	288	19.9
40	4.4	303	20.9
50	10.0	321	22.1
60	15.6	340	23.4
70	21.1	360	24.8
80	26.7	381	26.3
90	32.2	402	27.7
100	37.8	425	29.3
110	43.3	449	31.0
120	48.9	475	32.8
130	54.4	502	34.6

NOTE: The pressure tolerance at full operation is +15 psig.

4.2.2 Semi-Annual

The semi-annual maintenance must be performed by an authorized Context Plus distributor.

NOTE:

1. **Repeat weekly inspection**
2. **At least semi-annually, the quality of the agent and the pressure of refillable containers shall be checked. If a container shows a loss in net weight of more than 5% or a loss in pressure (adjusted for temperature) of more than 10%, it shall be refilled or replaced. Inspection of the 35 lb and 70 lb cylinders has to be weighed. The 150 lb, 250 lb, 375 lb, 560 lb, and the 1200 lb cylinder can be inspected using the Liquid Level Indicator or a scale.**

   Note: Operation of Liquid Level Indicator

   Level readout is obtained by simply removing the protective cap and pulling out a calibrated tape until magnetic interlock with the float is felt. With the tape in this position, the reading is obtained at the point where the tape emerges from the unit housing. With the graph (one per cylinder size), the tape reading is converted to lbs. of Clean Agent in the cylinder. Graph data is collected for 70˚ F operations. From the reading in Y axis (in inches), go over to the line and drop down to the X axis for the reading in lbs. of agent in the cylinder. Tolerance of the unit is ±2% of cylinder fill weight.

3. **Perform functional test to all components of the entire system (see "Hardware Checkout after Installation")**

4.3 System Checkout after Discharge

Before entering the enclosure after HFC-227ea discharge, ventilate the enclosure thoroughly. The HFC-227ea does not leave a residue, thus, there are no clean-up operations resulting from the HFC-227ea discharge. An authorized installer or system designer must be consulted after the system has discharged. The cylinder must be removed from the bracket to be recharged with the HFC-227ea and re-pressurized with nitrogen.

1. Disconnect solenoid wiring from control panel, or 110 volts circuit when no panel is used. Remove coil from solenoid assembly by removing the retaining nut and sliding the coil off the shaft.
2. When piston actuators are being used, no venting of the actuator tubing is required.
3. Remove all pressure actuating tubes from cylinder adapters.
4. Remove all pressure actuating tubes and the piston actuators from the top plug adapters. The pistons are to be manually pushed back to the top of the piston actuators.

   CAUTION: Failure to reset the piston actuator before returning it to service will result in an unwanted discharge of the system.

5. Remove all Local Manual Control Heads from the cylinder adapters. The Local Manual Control Head is reset by pulling out the lock-pin, and at the same time, lifting the handle. The pull-pin and plastic seal must be in place at all times when the control is not in use. See Figure75.

CAUTION: Failure to reset the control head before returning it to service will result in an unwanted discharge of the system during installation.

6. Remove cylinder piping from cylinder valves.
7. Attach anti-recoil plugs on all cylinders.
8. Loosen cylinder brackets and remove the cylinders.
9. Have all cylinders recharged only by a qualified Context Plus HFC-227ea recharge facility.

NOTE: Only Context Plus qualified HFC-227ea recharge personnel shall inspect cylinder, valve, and controls for nicks, corrosion, and impairment of parts.

10. Replace all parts as necessary. Check nozzles for any damages, misalignment or foreign matters. After system discharges through a shuttle valve, functionally test the shuttle valve for free movement. Follow all instructions on the cylinder nameplate. If the valve is to be disassembled to lubricate the “o” ring, make sure the pressure within the cylinder is at ZERO psig. To make sure there is no residual pressure within the cylinder, install the anti-recoil fittings on the discharge outlet, and actuate the cylinder valve.

CAUTION: DO NOT BREATHE THE GAS VENTING FROM THE ANTI-RECOIL.

Only the bore of the valve and the piston “o” ring shall be greased with the Context Plus CP 50172 grease. The seating surface in the valve and the rubber piston seat shall NOT be greased. Only the Context Plus CP 50172 grease shall be used.

11. After the recharging has been completed, replace cylinders in brackets and re-fasten the brackets.
12. Remove anti-recoil plugs.
13. Re-connect discharge piping.
14. Reset control panel.
15. Reconnect all mechanical control heads.
16. Re-install the solenoid coils on the solenoids, and replace the nut if removed. Check that all wire nuts are reconnected.
17. Reconnect all pressure actuators and pressure actuation tubing.
18. Follow instructions given in “Hardware Checkout after Installation”.

NOTE: This system consists of components tested within limitations contained in this manual. The designer of this system must be consulted prior to any planned changes to either the system or the area being protected. An authorized Context Plus distributor must be consulted after the system has discharged.

Table 24: Context Plus Part Numbers

Context Plus Part Number	Description
Clean Agent	
HFC-227ea	Context Plus 227 Fire Protection Fluid
Cylinders and Valves	
CP 10014	35 lb cylinder
CP 10015	70 lb cylinder
CP 60153	150 lb cylinder
CP 60152	250 lb cylinder
CP 60151	375 lb cylinder
CP 60150	560 lb cylinder
CP 91210	1200 lb. cylinder
CP 90001	1”valve assy.
CP 90002	1-1/2”valve assy.
CP 90003	2-1/2”valve assy.
CP 91004	4”valve assy.
CP 50021	Anti-recoil for 1”valve
CP 60611	Anti-recoil for 1-1/2”valve
CP 60032	Anti-recoil for 2-1/2”valve
CP 91219A	Anti-recoil for 4” valve
CP 60055	Burst disc assy. for 35 – 560 lb. cylinder
CP 23-0190-001	Burst disc assy. for 1200 lb. cylinder
CP 90035-E	35 lb cylinder / 1”valve Assembly
CP 90070-E	70 lb cylinder / 1”valve Assembly
CP 90150-E	150 lb cylinder / 1-1/2”valve Assembly
CP 90250-E	250 lb cylinder / 1-1/2”valve Assembly
CP 90375-E	375 lb cylinder / 2-1/2”valve Assembly
CP 90560-E	560 lb cylinder / 2-1/2”valve Assembly
CP 91200-E	1200 lb cylinder / 4”valve Assembly
Cylinder Brackets	
CP 50139	Wall strap for 35 lb and 70 lb cylinders
CP 60780	Wall strap for 150 lb cylinders
CP 60760	Wall strap for 250 lb and 375 lb cylinders
CP 60770	Wall strap for 560 lb cylinders
CP60790	Wall strap for 1200 lb cylinders
CP60772	Floor strap for 1200 lb cylinders
Pressure Gauges	
CP 27-15-18	240 psig pressure gauge
CP 27-15-17	360 psig pressure gauge

Context Plus Part Number	Description
Cylinder Valve Controls	
CP 50025-2	11 Watts electric solenoid
CP 50025-6	15 Watts electric solenoid
CP 61033	Local manual control head * use with electric solenoid
CP 61041	Piston actuator
CP 50026	Latching solenoid
CP 61033-2	Local manual control head * use with latching solenoid
CP 50022	Top plug for 1”valve
CP 60604	Top plug for 1-1/2”valve
CP 60007	Top plug for 2-1/2”valve
CP 91212	Top plug for 4”valve
CP 61053	Top plug adapter assembly for 1”valve
CP 61054	Top plug adapter assembly for 1-1/2”valve
CP 61055	Top plug adapter assembly for 2-1/2”valve
CP 91222	Top plug adapter assembly for 4”valve
Agent Distribution Devices	
CP60704-2-.XXXX	1/2” (180°) sidewall nozzle
CP60704-3-.XXXX	1/2” (360°) central nozzle
CP60705-2-.XXXX	3/4” (180°) sidewall nozzle
CP60705-3-.XXXX	3/4” (360°) central nozzle
CP60706-2-.XXXX	1” (180°) sidewall nozzle
CP60706-3-.XXXX	1” (360°) central nozzle
CP60707-2-.XXXX	1-1/4” (180°) sidewall nozzle
CP60707-3-.XXXX	1-1/4” (360°) central nozzle
CP60708-2-.XXXX	1-1/2” (180°) sidewall nozzle
CP60708-3-.XXXX	1-1/2” (360°) central nozzle
CP60709-2-.XXXX	2” (180°) sidewall nozzle
CP60709-3-.XXXX	2” (360°) central nozzle
CP 60255	1” flex hose with male NPT thread on both ends
CP 60256	1-1/2” flex hose with male NPT thread on both ends
CP 60257	2-1/2” flex hose with male NPT thread on both ends
CP 91230	4” flex hose with Victaulic fittings on both ends and stainless steel braided
CP 91231	4” flex hose & check valve assembly with Victaulic fittings on both ends and stainless steel braided
CP 50123	1”shuttle check valve
CP 60619	1-1/2” shuttle check valve
CP 60261	1”manifold check valve
CP 60262	1-1/2”manifold check valve
CP 60263	2-1/2”manifold check valve
CP 60264	4”manifold check valve
Accessories	
CP 55200	Weather proof manual control – electrical pull station (model # RMS-1T-WP)
CP 55201	Dual action manual control – electrical pull station “Context Plus 227 AGENT RELEASE” (model # RMS-1T-LP-KL)

Context Plus Part Number	Description
CP 55201-1	Dual action manual control – electrical pull station (model # RMS-1T-LP)
CP 55201-2	Single action manual control – electrical pull station (model # RMS-1T)
CP 50195-1	Main-Reserve selector switch
CP 88105	Abort switch
CP 50138-1	Pressure supervisory switch (normally closed)
CP 50138-2	Pressure supervisory switch (normally open)
CP 50339	Pressure operated switch (N.C./N.O.) SPDT (manual reset) Model Number: CP 27
CP 60020	Liquid level indicator for 150 lb to 250 lb cylinders
CP 60020-1	Liquid level indicator for 375 lb to 560 lb cylinders
CP 60020-2	Liquid level indicator for 1200 lb cylinders
Software	
HFC227-SW	HFC-227ea FlowCalc software CP3.10
HFC227-SWK	Additional key for HFC-227ea FlowCalc software CP3.10
Maintenance	
CP 50310	Test dowel for solenoid
CP 5000-3	1” valve service kit
CP 5000	1-1/2” valve service kit
CP 5000-1	2-1/2” valve service kit
CP 5000-12	4” valve service kit
CP 50172	Piston grease fortified
CP 50146	Recharge adapter for 1” valve
CP 60850	Recharge adapter for 1-1/2” valve
CP 60852	Recharge adapter for 2-1/2” valve
CP 60858	Recharge adapter for 4” valve
CPHTA1	Hydrostatic test adapter for 1”valve
CPHTA2	Hydrostatic test adapter for 1-1/2”valve
CPHTA3	Hydrostatic test adapter for 2-1/2”valve
CPHTA4	Hydrostatic test adapter for 4”valve
CP-90225-D-4	Installation, Maintenance, and Service Technical Manual



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